United States
Department of
Agriculture

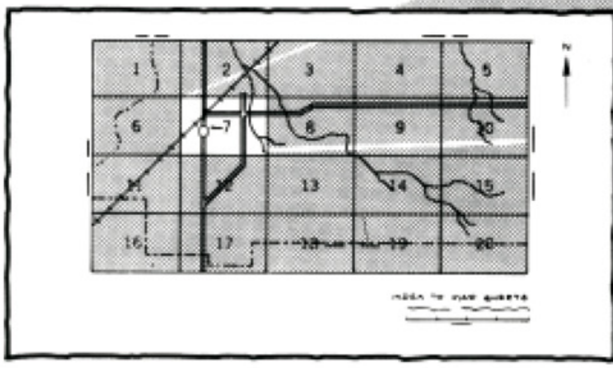
Soil
Conservation
Service

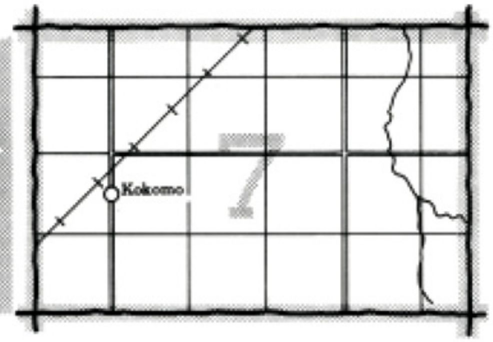
In cooperation with
Purdue University
Agricultural Experiment
Station and Indiana
Department of Natural
Resources, Soil and Water
Conservation Committee

Soil Survey of Rush County, Indiana

HOW TO USE

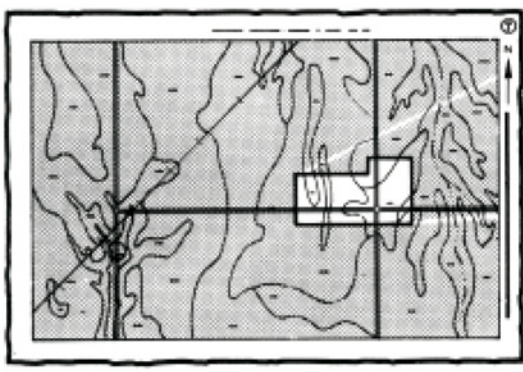
1. Locate your area of interest on the ''Index to Map Sheets''

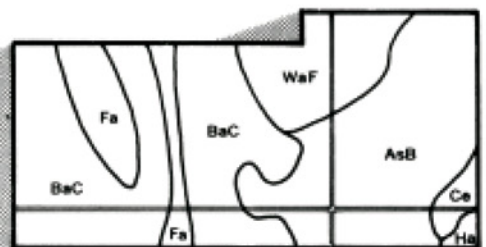




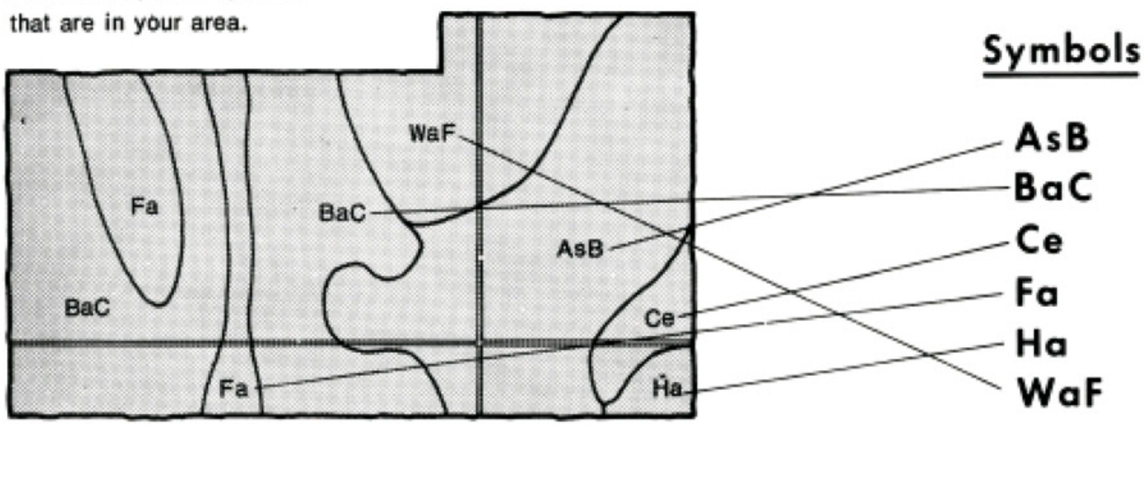
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



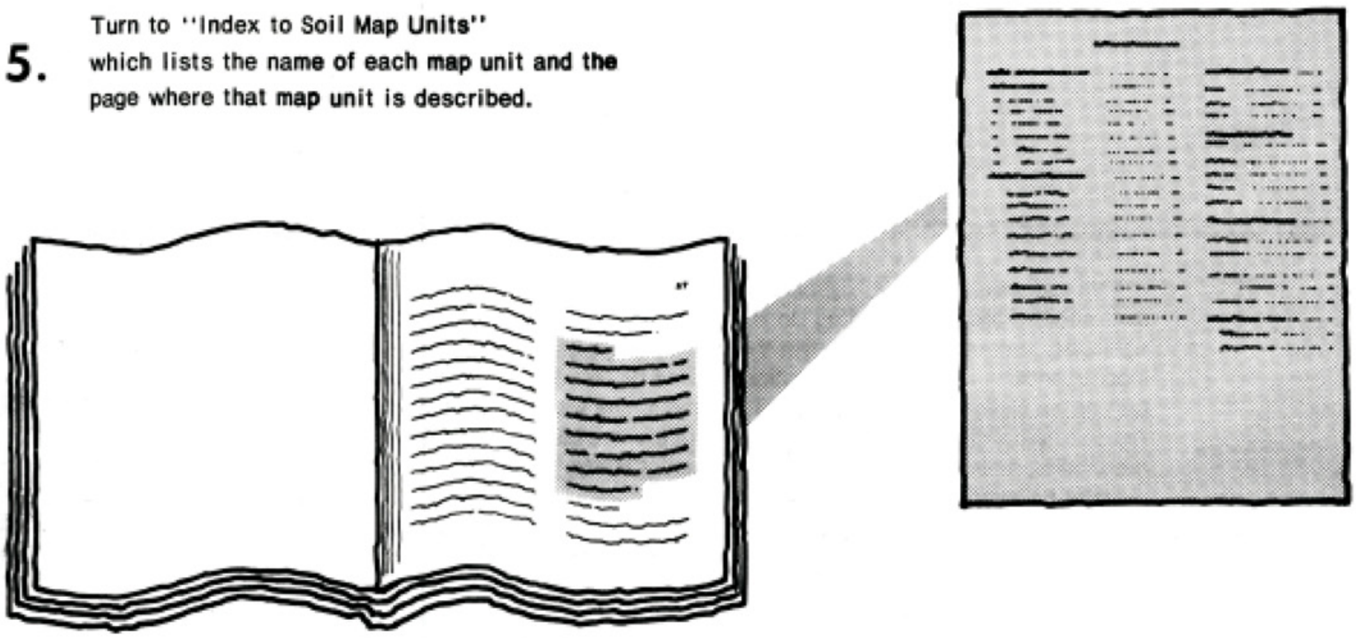


4. List the map unit symbols that are in your area.

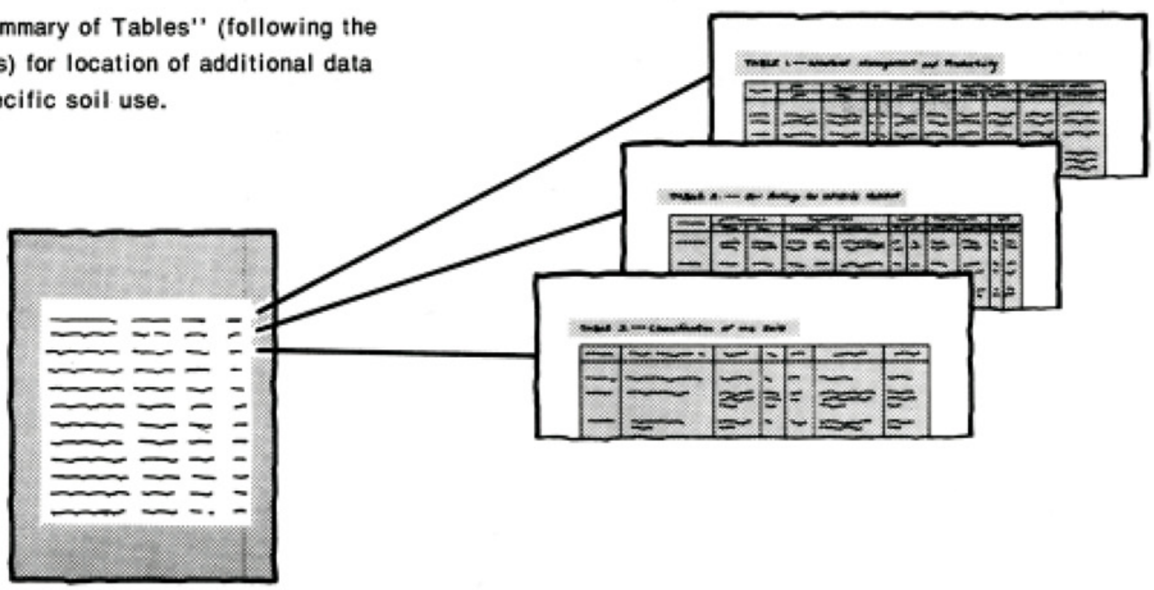


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed during the period 1978-81. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service, the Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Rush County Soil and Water Conservation District. Financial assistance was made available by the Board of County Commissioners of Rush County.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Corn grown for feeding and seed. This crop is of major importance to the economy of Rush County.

Contents

Soil Series

Issued January 1986

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Rush County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L. Eddleman

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State Conservationist
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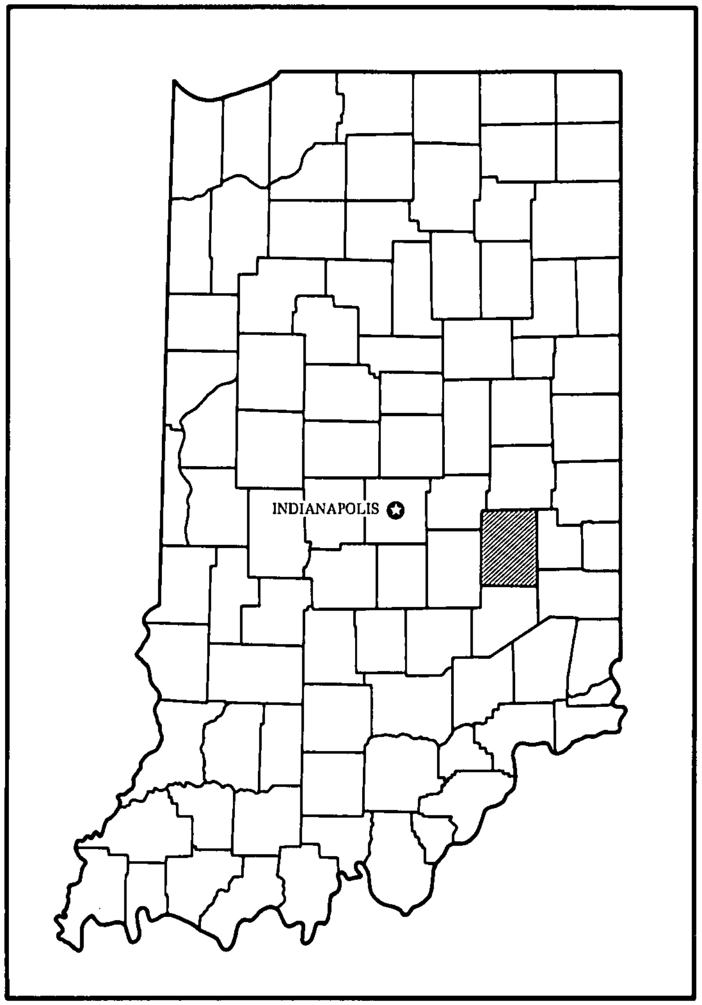

Location of Rush County in Indiana.

Soil Survey of Rush County, Indiana

By Rex A. Brock, Soil Conservation Service

Fieldwork by Rex A. Brock, Soil Conservation Service,
and Michael Dalton and Mary R. Kimball, Indiana Department of
Natural Resources, Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Purdue University Agricultural Experiment Station
and Indiana Department of Natural Resources,
Soil and Water Conservation Committee

RUSH COUNTY is in east-central Indiana (see map on facing page). It has a land area of 261,267 acres, or 409 square miles. It extends about 23 miles from north to south and 18 miles from west to east. Rushville, the county seat, is in the central part of the county.

About 83 percent of the county is actively farmed (*3*). The climate favors cash-grain and livestock farming. Corn, soybeans, and wheat are the principal cash-grain crops. Hogs, beef cattle, and dairy cattle are the main kinds of livestock. Truck farms are few and small, but they are productive. Some tobacco is grown in the southern part of the county.

Soil scientists have determined that there are about 34 different kinds of soil in the county. The soils range widely in texture, natural drainage, and other characteristics. The nearly level soils away from the major streams are loamy and are somewhat poorly drained or poorly drained. Wetness is a major limitation affecting the use of these soils. Because of extensive tile drainage, the soils are well suited to cultivated crops. Because of the wetness, however, they are generally poorly suited to most uses associated with urban development.

The more rolling areas were formed when they were dissected by small streams. The soils in these areas are loamy and are moderately well drained or well drained. The hazard of erosion is generally severe. If well managed, these soils are fairly well suited to field crops and pasture. They also are fairly well suited to most uses associated with urban development if erosion is controlled.

The nearly level and gently sloping soils on terraces along the Flatrock and Big Blue Rivers are loamy and well drained. They are well suited to farming and to most uses associated with urban development.

This survey updates the soil survey of Rush County published in 1937 (*4*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the County

This section provides information about the climate; physiography, relief, and drainage; history; water supply; transportation facilities; industries and agriculture-related businesses; and trends in land use in Rush County.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Rush County is cold in winter but quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all crops that are adapted to the temperature and length of the growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Shelbyville, Indiana, in

the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Shelbyville on January 28, 1963, is -23 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 40.49 inches. Of this, 23 inches, or more than 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.13 inches at Shelbyville on July 30, 1961. Thunderstorms occur on about 45 days each year, and most occur in summer. Tornadoes and severe thunderstorms strike occasionally. They usually are of local extent and short duration and cause damage in a variable pattern.

The average seasonal snowfall is about 14 inches. The greatest snow depth at any one time during the period of record was 10 inches. On the average, 8 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 70 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

The southeastern part of Rush County is on a gently sloping plain known as the Muscatatuck Regional Slope. The rest of the county is on a depositional plain of low relief known as the Tipton Till Plain. Glaciation rather than the underlying bedrock was the principal factor responsible for the present landforms. Except for about 40 acres of Illinoian glacial drift in the southeast corner, the county was completely covered by ice of Wisconsin glacial period. Two advancements were made by the Wisconsin glacier into the county. Deposits from the first one generally are exposed only in the area southeast of the Flatrock River. The second advancement extended only as far as the Flatrock River in most areas. Deposits from this advancement completely covered the earlier deposits northwest of the Flatrock River. The soils formed in the earlier stage are more deeply leached and are covered by a thicker cap of wind-deposited material. Only slight changes have been made by post-Wisconsin glacial streams. Relief is strongest along the breaks between the nearly level uplands and the terraces and bottom land along the streams that drain the county.

The highest elevation, about 1,135 feet above sea level, is in an area about 1.25 miles south of Glenwood (sec. 4, T. 13 N., R. 11 E.). The lowest, about 830 feet above sea level, is in an area on bottom land where the Flatrock River leaves the county, in the southwestern part (sec. 29, T. 12 N., R. 9 E.). The average elevation is about 975 feet.

The general drainage pattern is from the northeast to the southwest. The Flatrock River cuts diagonally across the county. This river and its tributaries drain most of the county. Other major streams are the Big Blue River and Conns Creek, in the north-central part of the county, and the Little Flatrock River, in the south-central part. Water from all of the streams eventually drains into the Wabash River and then into the Ohio River. In the southeast corner of the county, the South Fork Little Salt Creek and Bull Fork run from the northwest to the southeast. Water from these creeks drains into the Whitewater River and then into the Ohio River.

Natural drainage is poor in the county. Marshes and swamps were common before drainage systems were installed. In most areas open ditches and tile drains are needed if crops are grown.

History

The Delaware Indians were the original inhabitants of the area now known as Rush County. They ceded the land to the United States in the fall of 1818. Soon after, Enoch Russell became the first permanent settler. In 1819, he built his cabin about 1.5 miles north of what is now New Salem. The county was established by the Indiana Legislature in 1821. It was named after Dr. Benjamin Rush, a prominent Philadelphia physician and signer of the Declaration of Independence. In 1822, Rushville was made the county seat. It was Wendell Willkie's headquarters for the presidential campaign of 1940.

The extremely fertile land attracted many settlers from the East and South. The first farms were on the well drained soils along streams. The poorly drained, nearly level soils on uplands were not farmed until ditches and tile improved drainage.

The county had a population of 10,000 in 1830; 19,400 in 1930; 20,350 in 1970; and 19,604 in 1980.

Water Supply

The water supply for farms, homes, and industries comes from wells. The depth to a good source of ground water averages 80 feet. It ranges from 50 to 150 feet. Public water supplies are available at Rushville, Carthage, Glenwood, and Milroy. The ones at Rushville, Carthage, and Glenwood are from wells developed in sand and gravel formations. The one at Milroy is from wells developed in limestone.

Transportation Facilities

Because of its location in east-central Indiana, Rush County is a crossroads in the area. U.S. Highway 52 and State Highway 44 run generally east and west through Rushville. State Highway 3 runs north and south through Rushville. State Highway 244 runs east and west through the southern part of the county. State Highway 140 runs north and south through the northern part. Interstate Highway 70 is just to the north of the county, and Interstate Highway 74 is just to the south and southwest. There are about 775 miles of county roads. Most of these roads are paved.

Ten interstate and three intrastate truck lines serve the county. Two railroads provide rail service. Indianapolis International Airport is reasonably close to the county.

Industries and Agriculture-Related Businesses

Rushville has several industries, and Arlington, Carthage, Mays, and Milroy have a few small ones. The industries manufacture various items, including paper, piston rings, tractor cabs, furniture, air-conditioning equipment, seed corn, and crushed stone. They use much of the labor force in Rush County. Industry has grown somewhat slowly, however, and has not kept up with the pace of younger people entering the job market. Therefore, many residents work in surrounding counties or commute to Indianapolis to work. In 1970, about 66 percent of the work force was employed within the county and 29 percent outside the county. The remaining 5 percent was unreported.

Most grain is marketed through the many elevators in the county. The grain is then shipped to larger terminals in Cincinnati or Indianapolis. From Cincinnati, it is shipped on barges down the Ohio River. From Indianapolis, it is shipped by rail to the East Coast.

Most of the livestock in the county is marketed through several local markets. It is then shipped to the major market in Indianapolis.

Trends in Land Use

Urban development has been slow in Rush County. A small percentage of the farmland has been converted to nonfarm uses in the last 25 to 30 years.

Farming is still by far the major land use in the county. The soils are well suited to most agricultural uses. The number of farms has decreased, but the average size of each farm has increased greatly. Several farms are more than 1,000 acres in size. Cropping systems are more intensive than they were in the past. Row crops are grown year after year on many farms. Corn and soybeans are the chief cash crops. Soft red winter wheat is the most common small grain. Tomatoes, sweet corn, peas, and other vegetables were fairly important economically at one time. They were grown on about 2,400 acres in 1939. Tomatoes are still grown in a few areas in the southern part of the county.

Some farms raise livestock. Most of these specialize in one kind of livestock, chiefly hogs. Beef and dairy enterprises are fairly common. A few farms raise poultry and sheep.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil

profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their suitability for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It indicates the suitability of each for major land uses and shows soil properties that limit use. Each map unit is rated for *corn, soybeans, and small grain; grasses and legumes for hay and pasture; woodland; septic tank absorption fields;* and *building site development*.

The names, descriptions, and delineations of the soils identified on the general soil map of this survey area do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Soil Descriptions

1. Genesee-Sloan-Shoals

Deep, nearly level, well drained, very poorly drained, and somewhat poorly drained soils formed in alluvial deposits; on bottom land

This map unit is on flood plains along the larger streams. Areas are long and narrow and follow the drainageways, generally from the northeast to the southwest. The flood plains are characterized by very little relief. Slopes range from 0 to 2 percent.

This map unit makes up about 5 percent of the survey area. It is about 39 percent Genesee soils, 21 percent Sloan soils, 15 percent Shoals soils, and 25 percent minor soils.

Genesee soils are well drained and are generally in the higher lying areas on the bottom land. Typically, they have a surface layer of dark grayish brown loam and a subsoil of brown loam.

Sloan soils are very poorly drained and are in depressional areas on the bottom land. Typically, they have a surface layer of very dark grayish brown silt loam and a subsoil of dark gray and gray, mottled loam.

Shoals soils are somewhat poorly drained and are generally in the lower lying areas on the bottom land. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of brown, dark grayish brown, and yellowish brown, mottled silt loam and loam.

The minor soils are the well drained Ockley and Eldean soils on small terraces and knobs between the flood plains and uplands and the very poorly drained Westland soils in depressions on terraces and outwash plains.

Most of the soils in this map unit have been cleared and are used for corn and soybeans. A few areas are used as pasture, hayland, or woodlots. The soils are suited to corn and soybeans and to grasses and legumes for hay and pasture, but they are poorly suited to small grain. Flooding is the major hazard. It usually destroys stands of small grain unless it is controlled.

The soils in this map unit are well suited to trees. Since the unit is suited to cultivated crops, however, very few areas are used for trees.

This unit is generally unsuited to septic tank absorption fields and building site development because of the flooding hazard.

2. Miami-Xenia-Russell

Deep, nearly level to steep, well drained and moderately well drained soils formed in loess and the underlying glacial till; on uplands

This map unit consists of nearly level to steep soils on glacial till plains. Steeper slopes are along the many drainageways that dissect this unit. Most areas are drained by small streams. Slopes range from 1 to 35 percent.

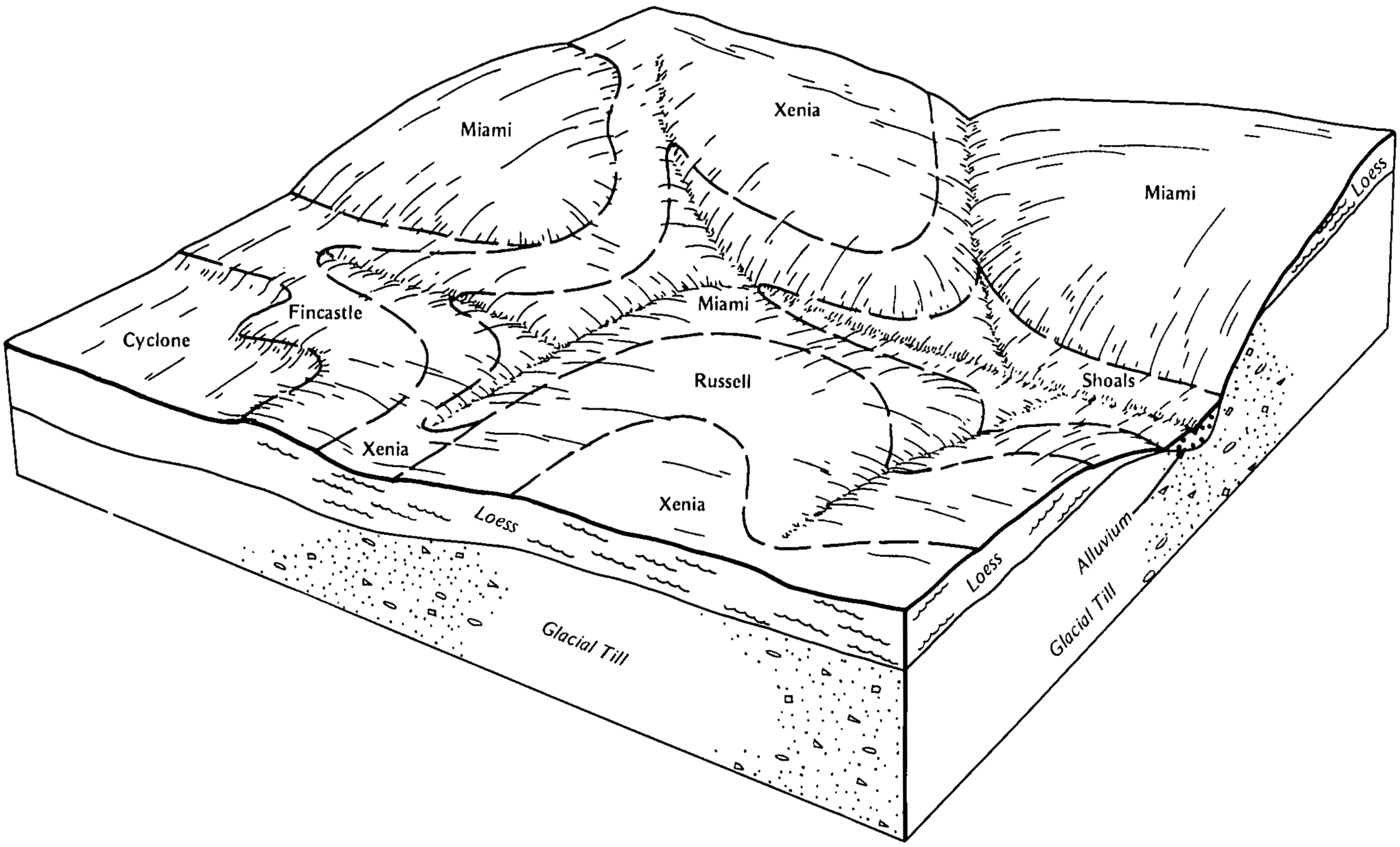

Figure 1.—Pattern of soils and parent material in the Miami-Xenia-Russell map unit.

This map unit makes up about 12 percent of the survey area. It is about 36 percent Miami soils, 30 percent Xenia soils, 15 percent Russell soils, and 19 percent minor soils (fig. 1).

Miami soils are well drained and are on knobs, side slopes, and breaks along drainageways. They are gently sloping to steep. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown silty clay loam, clay loam, and loam.

Xenia soils are moderately well drained and are in nearly level and gently sloping areas. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of dark yellowish brown and yellowish brown, mottled silty clay loam and clay loam.

Russell soils are well drained and are on the gentle breaks close to the drainageways. They are gently sloping. Typically, they have a surface layer of brown silt loam and a subsoil of brown and dark yellowish brown silt loam, silty clay loam, and clay loam.

The minor soils are the poorly drained Cyclone soils in depressional areas, the somewhat poorly drained Fincastle soils in nearly level areas, and the somewhat poorly drained Shoals soils on bottom land along streams.

In most areas this map unit has been cleared. It is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The slope and the hazard of erosion are the main management concerns.

The soils in this map unit are well suited to trees. The woodland dominantly supports white oak, northern red oak, yellow-poplar, and sugar maple.

This unit is suited to septic tank absorption fields and building site development. The slope, the hazard of erosion, moderately slow permeability, frost action, and low strength are the main management concerns.

3. Fincastle-Cyclone-Xenia

Deep, nearly level and gently sloping, somewhat poorly drained, poorly drained, and moderately well drained soils formed in loess and the underlying glacial till; on uplands

The map unit consists of broad areas of nearly level and gently sloping soils on glacial till plains. It is characterized by many depressional areas and many

nearly level and gently sloping areas along drainageways. Much of this unit is drained artificially, but some large areas are drained by small streams. Slopes range from 0 to 4 percent.

This map unit makes up about 22 percent of the survey area. It is about 37 percent Fincastle soils, 34 percent Cyclone soils, 15 percent Xenia soils, and 14 percent minor soils (fig. 2).

Fincastle soils are somewhat poorly drained and are on slight rises. They are nearly level. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of yellowish brown and brown, mottled silty clay loam and clay loam.

Cyclone soils are poorly drained and are in depressional areas. They are nearly level. Typically, they have a surface layer of very dark grayish brown silty clay loam and a subsoil of very dark grayish brown, dark gray, and gray, mottled silty clay loam and loam.

Xenia soils are moderately well drained and are on rises and on gentle breaks along drainageways. They are nearly level and gently sloping. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of dark yellowish brown and yellowish brown, mottled silty clay loam and clay loam.

The minor soils are the well drained Miami and Russell soils on knobs and breaks along drainageways and the moderately well drained Williamstown soils on small rises and in gently sloping areas around drainageways.

Most of this map unit has been cleared and drained and is used for corn, soybeans, and small grain. Some areas are used as pasture, hayland, or woodlots. The soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Wetness is the main limitation.

The soils in this map unit are well suited to trees. Since the unit is well suited to cultivated crops, however, very few areas are used for trees.

This unit is generally unsuited to septic tank absorption fields and building site development because of wetness, moderately slow permeability, frost action, and low strength.

4. Crosby-Treaty

Deep, nearly level, somewhat poorly drained and very

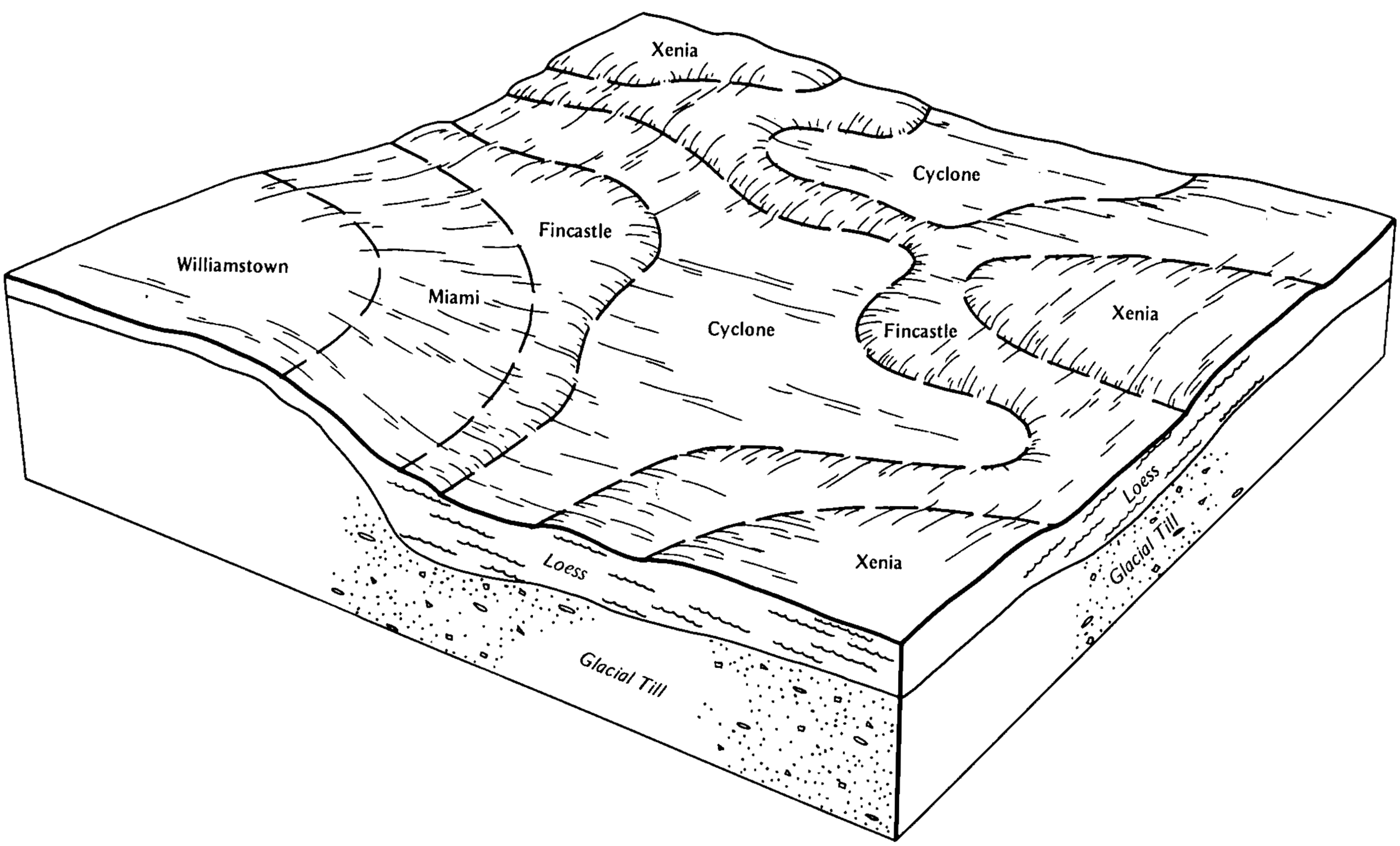

Figure 2.—Pattern of soils and parent material in the Fincastle-Cyclone-Xenia map unit.

poorly drained soils formed in loess and the underlying glacial till; on uplands

This map unit consists of broad areas of nearly level soils on glacial till plains. The till plains are characterized by very little relief and by many depressional areas. Most areas are drained artificially, but some are drained by small streams. Slopes range from 0 to 3 percent.

This map unit makes up about 42 percent of the survey area. It is about 44 percent Crosby soils, 34 percent Treaty soils, and 22 percent minor soils (fig. 3).

Crosby soils are somewhat poorly drained and are on the higher lying, broad flats and slight rises. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of dark grayish brown, brown, and yellowish brown, mottled silt loam, silty clay loam, and clay loam.

Treaty soils are very poorly drained and are in depressional areas and along narrow drainageways. Typically, they have a surface layer of very dark gray silty clay loam and a subsoil of gray and yellowish brown, mottled silty clay loam, clay loam, and loam.

The minor soils are the well drained Miamian soils on knobs and breaks along drainageways.

Most of this map unit has been cleared and drained and is used for corn, soybeans, and small grain. Some areas are used as pasture, hayland, or woodlots. The soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Wetness is the main limitation.

The soils in this map unit are well suited to trees. Since the unit is well suited to cultivated crops, however, very few areas are used for trees.

This unit is generally unsuited to septic tank absorption fields and building site development because of wetness, moderately slow permeability, frost action, and low strength.

5. Miamian

Deep, gently sloping to steep, well drained soils formed in loess and the underlying glacial till; on uplands

This map unit consists of gently sloping to steep soils on glacial till plains. Steeper slopes are along the many

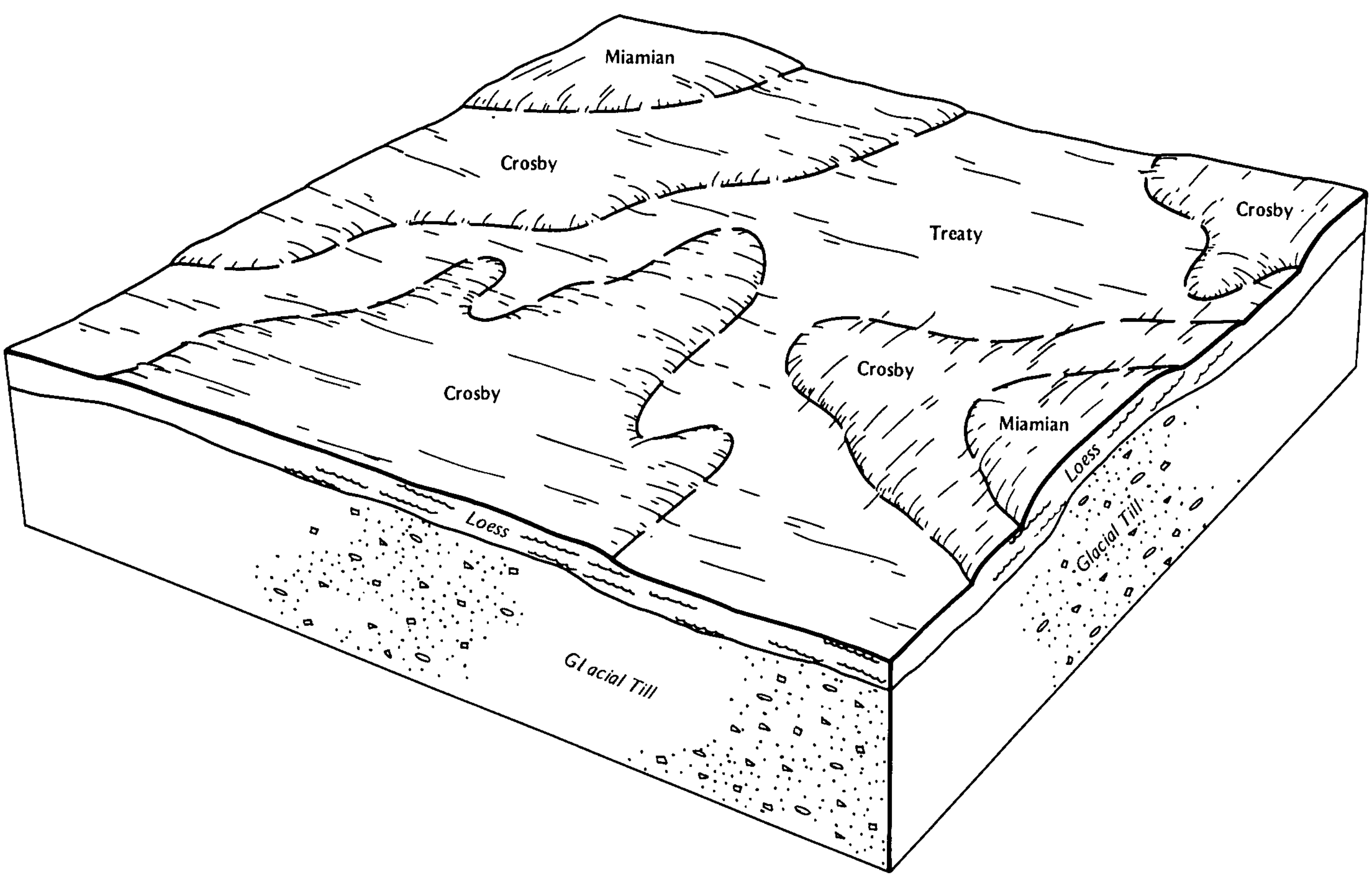

Figure 3.—Pattern of soils and parent material in the Crosby-Treaty map unit.

drainageways that dissect this unit. Most areas are drained by small streams. Slopes range from 2 to 35 percent.

This map unit makes up about 10 percent of the survey area. It is about 75 percent Miamian soils and 25 percent minor soils.

Miamian soils are on the gentle slopes close to the drainageways and on the steeper side slopes and breaks along the drainageways. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown clay and clay loam.

The minor soils are the somewhat poorly drained Crosby soils in the slightly lower lying areas, the very poorly drained Treaty soils in depressions, and the somewhat poorly drained Shoals soils on bottom land along streams.

In most areas this map unit has been cleared and is used for corn, soybeans, and small grain. The hilly areas are used as pasture, hayland, or woodlots. The less sloping soils are well suited to corn, soybeans, and small grain. The unit is well suited to grasses and legumes for hay and pasture. The slope and the hazard of erosion are the main management concerns in the more sloping areas.

The soils in this map unit are well suited to trees. The woodland dominantly supports white oak, northern red oak, yellow-poplar, and sugar maple. The slope and the hazard of erosion are the main management concerns in the more sloping areas.

This unit is suited to septic tank absorption fields and building site development. The slope, the hazard of erosion, moderately slow permeability, and frost action are the main management concerns.

6. Ockley-Westland-Sleeth

Deep, nearly level and gently sloping, well drained, very poorly drained, and somewhat poorly drained soils formed in glacial outwash deposits; on terraces and outwash plains

This map unit consists of nearly level and gently sloping soils on glacial terraces and outwash plains. Most areas are drained by small streams. Slopes range from 0 to 6 percent.

This map unit makes up about 9 percent of the survey area. It is about 44 percent Ockley soils, 32 percent Westland soils, 16 percent Sleeth soils, and 8 percent minor soils (fig. 4).

Ockley soils are well drained and are in the higher lying, broad areas and on rises. They are nearly level and gently sloping. Typically, they have a surface layer of brown silt loam and a subsoil of dark yellowish brown, dark brown, and dark reddish brown silt loam, clay loam, sandy clay loam, and gravelly sandy clay loam. The subsoil is underlain by coarse sand and gravelly coarse sand.

Westland soils are very poorly drained and are in broad depressional areas. They are nearly level. Typically, they have a surface layer of dark brown clay loam and a subsoil of very dark gray, grayish brown, and light gray, mottled clay loam and gravelly loam. The subsoil is underlain by coarse sand and gravelly coarse sand.

Sleeth soils are somewhat poorly drained and are on slight rises. They are nearly level. Typically, they have a surface layer of dark grayish brown silt loam and a subsoil of yellowish brown and grayish brown, mottled silty clay loam, silt loam, sandy clay loam, and gravelly sandy clay loam. The subsoil is underlain by coarse sand and gravelly coarse sand.

The minor soils are the well drained Eldean soils on slopes close to drainageways and on slope breaks between terraces and bottom land and the very poorly drained Sloan soils on bottom land along the larger streams.

Most of this map unit has been cleared and is used for corn, soybeans, and small grain. Some areas are used as pasture, hayland, or woodlots. The soils are well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Wetness is the main limitation in the lower lying and depressional areas.

The soils in this map unit are well suited to trees. Since the unit is well suited to cultivated crops, however, very few areas are used for trees.

This unit is poorly suited to septic tank absorption fields and building site development. The Ockley soils are moderately suited to these uses, but the Sleeth and Westland soils are generally unsuited because of wetness, frost action, and low strength.

Broad Land Use Considerations

The soils in Rush County vary in their potential for major land uses. About 65 percent of the acreage is used for cultivated crops, mainly corn, soybeans, and wheat (*3*). This cropland is distributed in all areas of the county, but it is more concentrated in map units 3, 4, and 6, which are well suited to corn, soybeans, and wheat. Wetness is the major limitation affecting the use of these units for crops. Most areas of these units have been artificially drained.

About 18 percent of the acreage is hayland and pasture (*3*). This land is in all areas of the county, but it is more concentrated in map units 1, 2, and 5, which are well suited to grasses and legumes. Flooding is the major hazard in areas of map unit 1, and the slope and erosion hazard are the main management concerns in areas of map units 2 and 5.

About 5 percent of the acreage is woodland (*3*). This land is concentrated mainly in map units 2 and 5, which are well suited to trees. The major soils used as woodland in these map units are Miami and Miamian soils.

About 12 percent of the acreage is urban or built up land (*3*). In general, the gently sloping and moderately

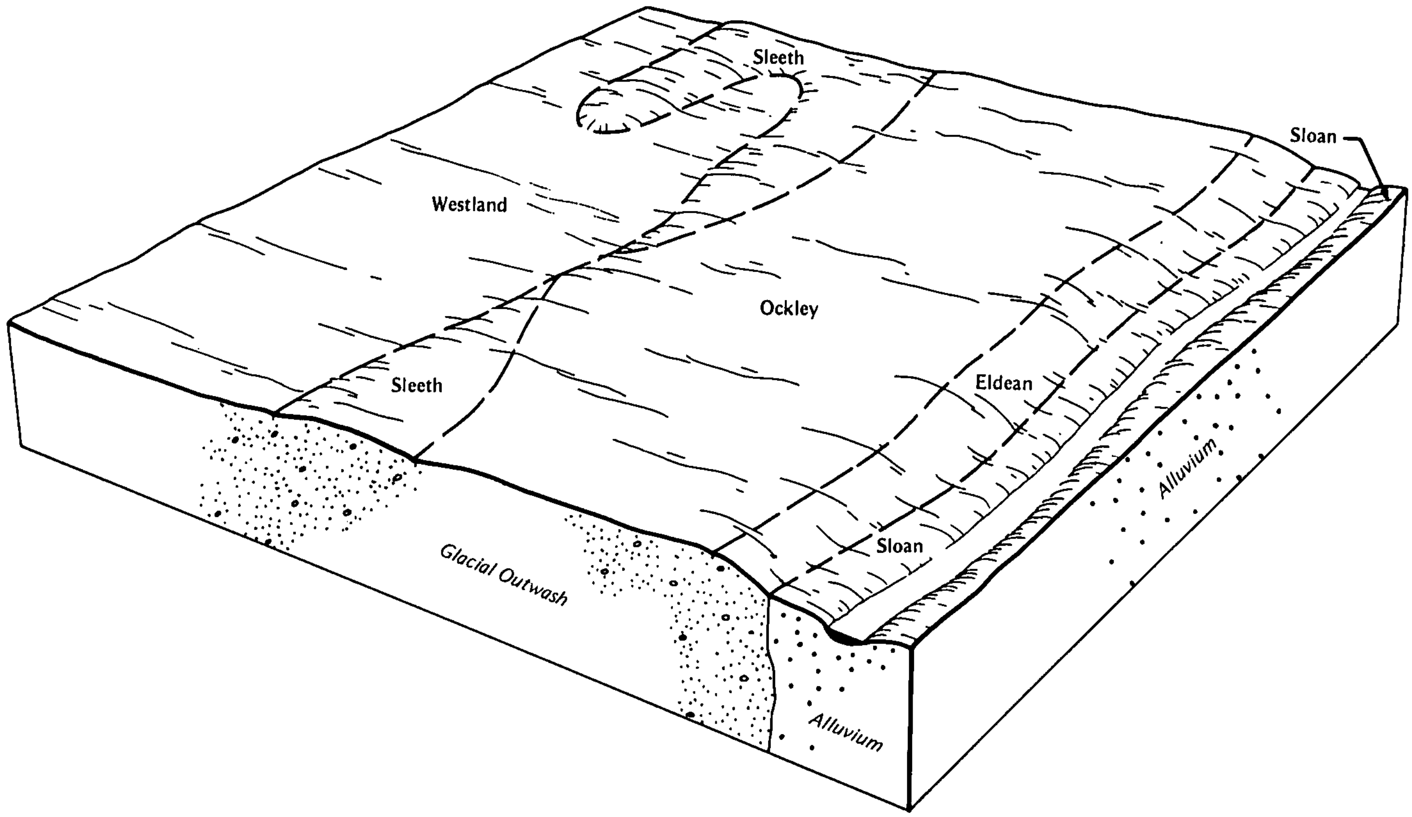

Figure 4.—Pattern of soils and parent material in the Ockley-Westland-Sleeth map unit.

sloping Miami and Miamian soils and the gently sloping Russell soils are suited to urban uses. These soils are mainly in map units 2 and 5. Moderately slow permeability, frost action, and low strength are the main limitations. The Ockley soils in map unit 6 are well suited to urban uses. Frost action and low strength are the main limitations. The other soils in this map unit and the ones in map units 3 and 4 are unsuited to urban uses because of wetness, frost action, moderately slow permeability, and low strength. The soils on flood plains, such as those in map unit 1, are unsuited to urban development because of the flooding hazard.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Miami silt loam, 2 to 6 percent slopes, eroded, is one of several phases in the Miami series.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarry, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this survey area do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

CeB2—Celina silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on small rises and in areas around drainageways on uplands. Areas are irregularly shaped and are 3 to 60 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsoil is about 25 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the next part is dark yellowish brown, firm clay loam; and the lower part is yellowish brown, firm clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In places the subsoil has more sand and less clay. In some areas the soil is severely eroded and has a clay loam surface layer. In some small areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the poorly drained Cyclone soils in depressions and small areas of the somewhat poorly drained Crosby soils on the slightly lower parts of the landscape. Also included are small areas of the well drained Miamian soils on the slightly higher parts of the landscape. Included soils make up about 3 percent of the unit.

Available water capacity is moderate in the Celina soil, and permeability is moderately slow. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 2.0 to 3.5 feet during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. An adequate drainage system is needed to lower the water table and keep the wetness from becoming a problem. Water moves slowly to drainage systems because of the moderately slow permeability. Dwellings should be constructed without basements. Properly designing foundations and backfilling with more stable material, such as sand and gravel, help to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. In areas where commercial sewers are not available, an enlarged absorption field should be installed. The water table should be lowered by an adequate subsurface drainage system in combination with storm sewers.

The land capability classification is IIe. The woodland ordination symbol is 1a.

CrA—Crosby silt loam, 0 to 3 percent slopes. This nearly level, deep, somewhat poorly drained soil is on slight rises in the uplands. Areas are irregularly shaped and are 3 to 200 acres in size. The dominant size is about 50 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 11 inches thick. The subsoil is about 25 inches thick. The upper part is dark grayish brown, mottled, friable silt loam, and the lower part is brown and yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of 60 inches is brown, mottled loam. In some areas the loess is more than 20 inches thick. In other areas the depth to the substratum is more than 40 inches. In some places the slope is more than 3 percent. In other places thin strata of silt and sand are in the substratum.

Included with this soil in mapping are small areas of the poorly drained Patton and very poorly drained Treaty soils in depressions. Also included are small areas of the well drained Miamian and moderately well drained Celina soils on the slightly higher rises. Included soils make up 5 to 10 percent of the unit.

Available water capacity is high in the Crosby soil, and permeability is slow. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 1 to 3 feet during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. The wetness is the main limitation. A drainage system is needed. Other concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because the wetness is a severe limitation, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the wetness and the slow permeability are

severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 3a.

Cy—Cyclone silty clay loam. This nearly level, deep, poorly drained soil is in broad depressional areas and narrow drainageways on uplands. It is subject to ponding. Areas are irregular in shape or fingerlike and are 3 to 400 acres in size. The dominant size is about 35 acres.

In a typical profile, the surface layer is very dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 58 inches thick. The upper part is very dark grayish brown and dark gray, mottled, firm silty clay loam; the next part is gray, mottled, firm silty clay loam; and the lower part is gray, mottled, friable loam. The substratum to a depth of 80 inches is yellowish brown, mottled loam. In some areas the silty clay loam layers are less than 40 inches thick, and in other areas they are more than 60 inches thick. In some places the soil has a thinner silty cap and has more sand in the lower part of the subsoil. In other places the soil has thin layers of lighter colored material, which has washed in from surrounding soils.

Included with this soil in mapping are small areas of the somewhat poorly drained Fincastle and moderately well drained Celina and Xenia soils on the higher parts of the landscape. These soils make up 5 to 10 percent of the unit.

Available water capacity is high in the Cyclone soil. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. If tilled when too wet, the surface layer becomes cloddy and hard to work. The soil has a water table at or above the surface during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn and soybeans. The ponding is the main hazard. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. The ponding is the main management concern. A drainage system is needed. Other concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is fairly well suited to wetland species of trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be overcome by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the ponding is a severe hazard, this soil is generally unsuited to building site development and septic tank absorption fields. Overcoming this hazard is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of ponding, frost action, and low strength. Drainage ditches are needed along the roads to lower the water table and to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 2w.

EdB2—Eldean loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on terraces, outwash plains, and end moraines. It is moderately deep over sand and gravel. Areas are elongated and are 3 to 20 acres in size. The dominant size is about 8 acres.

In a typical profile, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 25 inches thick. The upper part is brown, firm gravelly clay loam and gravelly sandy clay, and the lower part is dark brown, friable sandy clay loam. The substratum to a depth of 60 inches is yellowish brown, stratified coarse sand and gravelly coarse sand. In some areas the soil is deeper to calcareous sand and gravel and has less clay in the subsoil. In some small areas the soil is severely eroded and has a clay loam surface layer. In places the substratum is loam. In some small areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils on the less sloping parts of the landscape. These soils make up about 5 percent of the unit.

Available water capacity is low in the Eldean soil. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. The low available water capacity also is a concern. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Planting early in spring or planting early maturing crops, such as small grain, helps to prevent the adverse effects of drought in dry years. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface conserve moisture, help to control erosion, and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is suitable as a site for dwellings with basements. Properly designing the foundations and footings of dwellings without basements helps to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of a poor filtering capacity in the sand and gravel substratum. The absorption fields should be installed in areas away from sources of drinking water.

The land capability classification is IIe. The woodland ordination symbol is 2a.

EIC3—Eldean clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, well drained soil is on terraces, outwash plains, and end moraines. It is moderately deep over sand and gravel. Areas are elongated and are 3 to 20 acres in size. The dominant size is about 5 acres.

In a typical profile, the surface layer is dark brown clay loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part is dark brown, firm sandy clay loam, and the lower part is dark brown, friable coarse sandy loam. The substratum to a depth of 60 inches is brown, stratified coarse sand and gravelly coarse sand. In some areas the soil is deeper to calcareous sand and gravel and has less clay in the subsoil. In other areas the surface layer is gravelly sandy clay loam, gravelly clay loam, or loam. In places the substratum is loam. In some small areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils on the less sloping parts of the landscape. Also included are small areas where the topsoil and subsoil have been removed by erosion, leaving the sand and gravelly sand at or near the surface. Included soils make up about 10 percent of the unit.

Available water capacity is low in the Eldean soil. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is rapid. If tilled when too wet, the surface layer becomes cloddy and hard to work.

Most areas are used for cultivated crops. Some are used as pasture or hayland.

This soil is poorly suited to corn, soybeans, and small grain. Small grain can be grown in rotation with hay or pasture. Erosion is the main management concern. Measures that control erosion and surface runoff are needed if cultivated crops are grown. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface conserve moisture, help to control erosion, and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses and legumes for hay and well suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The shrink-swell potential also is a moderate limitation on sites for dwellings without basements. Properly designing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. Otherwise, extensive earthmoving may be needed to level the site sufficiently for construction. Erosion can be controlled by developing random lots rather than an extensive area and by retaining as much of the existing vegetation as possible. It also can be controlled by building roads on the contour, by establishing diversions between lots to intercept runoff, and by stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of a poor filtering capacity in the sand and gravel substratum. Absorption fields should be installed in areas away from sources of drinking water.

The land capability classification is IVe. The woodland ordination symbol is 2a.

EID3—Eldean clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, well drained soil is on terraces, outwash plains, and end moraines. It is moderately deep over sand and gravel. Areas are elongated and are 3 to 20 acres in size. The dominant size is about 8 acres.

In a typical profile, the surface layer is dark brown clay loam about 3 inches thick. The subsoil is about 22 inches thick. The upper part is dark brown and dark yellowish brown, firm gravelly clay loam, and the lower part is brown, firm gravelly sandy clay loam. The substratum to a depth of 60 inches is yellowish brown, stratified coarse sand and gravelly coarse sand. In some areas the soil is deeper to calcareous sand and gravel and has less clay in the subsoil. In other areas the surface layer is gravelly clay loam, gravelly sandy clay loam, or loam. In places the substratum is loam. In some small areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils on the less sloping parts of the landscape. Also included are small areas where the topsoil and subsoil have been removed by erosion, leaving the sand and gravelly sand at or near the surface. Included soils make up about 10 percent of the unit.

Available water capacity is low in the Eldean soil. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is very rapid. If tilled when too wet, the surface layer becomes cloddy and hard to work.

Most areas are used for cultivated crops. Some are used as pasture or hayland. This soil is generally unsuited to cultivated crops because of a severe hazard of erosion.

This soil is poorly suited to grasses and legumes for hay but is suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is fairly well suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Selective cutting of trees and construction of logging trails on the contour help to control erosion. Because the slope hinders the use of some machinery, special planting and harvesting equipment is needed. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the slope and a poor filtering capacity are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of slope and low strength. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic. Building on the contour helps to overcome the slope. Extensive road cuts may be necessary.

The land capability classification is VIe. The woodland ordination symbol is 2r.

FnA—Fincastle silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on slight rises in the uplands. Areas are irregularly shaped and are 3 to 200 acres in size. The dominant size is about 35 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface

layer is grayish brown silt loam about 3 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam, and the lower part is yellowish brown and brown, mottled, firm clay loam. The substratum to a depth of 60 inches is brown, mottled loam. In some areas the silt loam and silty clay loam layers are less than 20 or more than 40 inches thick. In other areas the loamy substratum is within a depth of 40 inches. In some places the slope is more than 2 percent. In other places the upper part of the subsoil is browner.

Included with this soil in mapping are small areas of the poorly drained Cyclone soils in depressions. Also included are small areas of the well drained Miami and Russell and moderately well drained Williamstown and Xenia soils on the slightly higher lying parts of the landscape. Included soils make up 3 to 5 percent of the unit.

Available water capacity is high in the Fincastle soil. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 1 to 3 feet during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. The wetness is the main management concern. A drainage system is needed. Other concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because the wetness is a severe limitation, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the wetness and the moderately slow permeability are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 3a.

Ge—Genesee loam, gravelly substratum. This nearly level, deep, well drained soil is on bottom land near the larger streams. It is frequently flooded for brief periods during winter and spring. Areas are elongated and are 3 to 200 acres in size. The dominant size is about 50 acres.

In a typical profile, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is brown, friable loam about 26 inches thick. The upper part of the substratum is yellowish brown and dark grayish brown, mottled loam. The lower part to a depth of 60 inches is brown gravelly coarse sand. In some areas the surface layer is darker. In other areas the soil contains less clay. In places gravelly coarse sand and coarse sand are within a depth of 50 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals and very poorly drained Sloan soils. These soils are in the slightly lower landscape positions or near areas where small drainageways outlet into the larger stream bottoms. They make up 5 to 10 percent of the unit.

Available water capacity is high in the Genesee soil, and permeability is moderate. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 3 to 6 feet during winter and spring.

Most areas are used for cultivated crops. This soil is well suited to corn and soybeans. It is poorly suited to small grain because flooding usually destroys the stands unless they are protected. Flooding during winter and spring is the main hazard. Selecting crops that can be planted and grown during periods when flooding is less frequent reduces the likelihood of crop damage. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Flooding is the main management concern. Protection from flooding is needed. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because the flooding is a severe hazard, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the flooding and the wetness are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of the flooding. Building the road up above the normal flood stage helps to prevent the damage caused by floodwater.

The land capability classification is IIw. The woodland ordination symbol is 1a.

MmB2—Miami silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises and along drainageways on uplands. Areas are irregular in shape and are 3 to 75 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 27 inches thick. It is dark yellowish brown and firm. The upper part is silty clay loam, the next part is clay loam, and the lower part is mottled loam. The substratum to a depth of 60 inches is yellowish brown, mottled loam. In some areas the silt loam and silty clay loam layers are more than 20 inches thick. In other areas the loam substratum is at a depth of more than 40 inches. In some places the subsoil is mottled throughout. In other places it has more clay or less sand. In some eroded areas the surface layer is loam or clay loam. In some small areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Fincastle soils on the lower parts of the landscape. Also included are small areas of the moderately well drained Williamstown and Xenia soils on the slightly lower parts of the landscape. Included soils make up about 3 percent of the unit.

Available water capacity is moderate in the Miami soil. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern (fig. 5). A cropping sequence that includes grasses and legumes, diversions, terraces, grassed waterways (fig. 6), contour farming, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing footings and foundations and backfilling with more stable material, such as sand and gravel, help to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion. The soil is severely limited as a site for local roads and streets because of frost action and low strength. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic. The soil is generally unsuited to septic tank absorption fields because the moderately slow permeability is a severe limitation. An enlarged absorption field should be installed to help overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 1a.

MmD—Miami silt loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped or slightly elongated and are 3 to 25 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark brown silt loam about 4 inches thick. The subsoil is about 34 inches thick. The upper part is brown, friable silt loam; the next part is dark yellowish brown, firm clay loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the silt loam or silty clay loam layers are more than 20 inches thick. In other areas the loam substratum is at a depth of more than 40 inches. In some eroded areas the surface layer is loam or clay loam. In places the subsoil has more clay or less sand. In some small areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of the moderately well drained Williamstown and Xenia soils on the less sloping parts of the landscape. These soils make up about 3 percent of the unit.

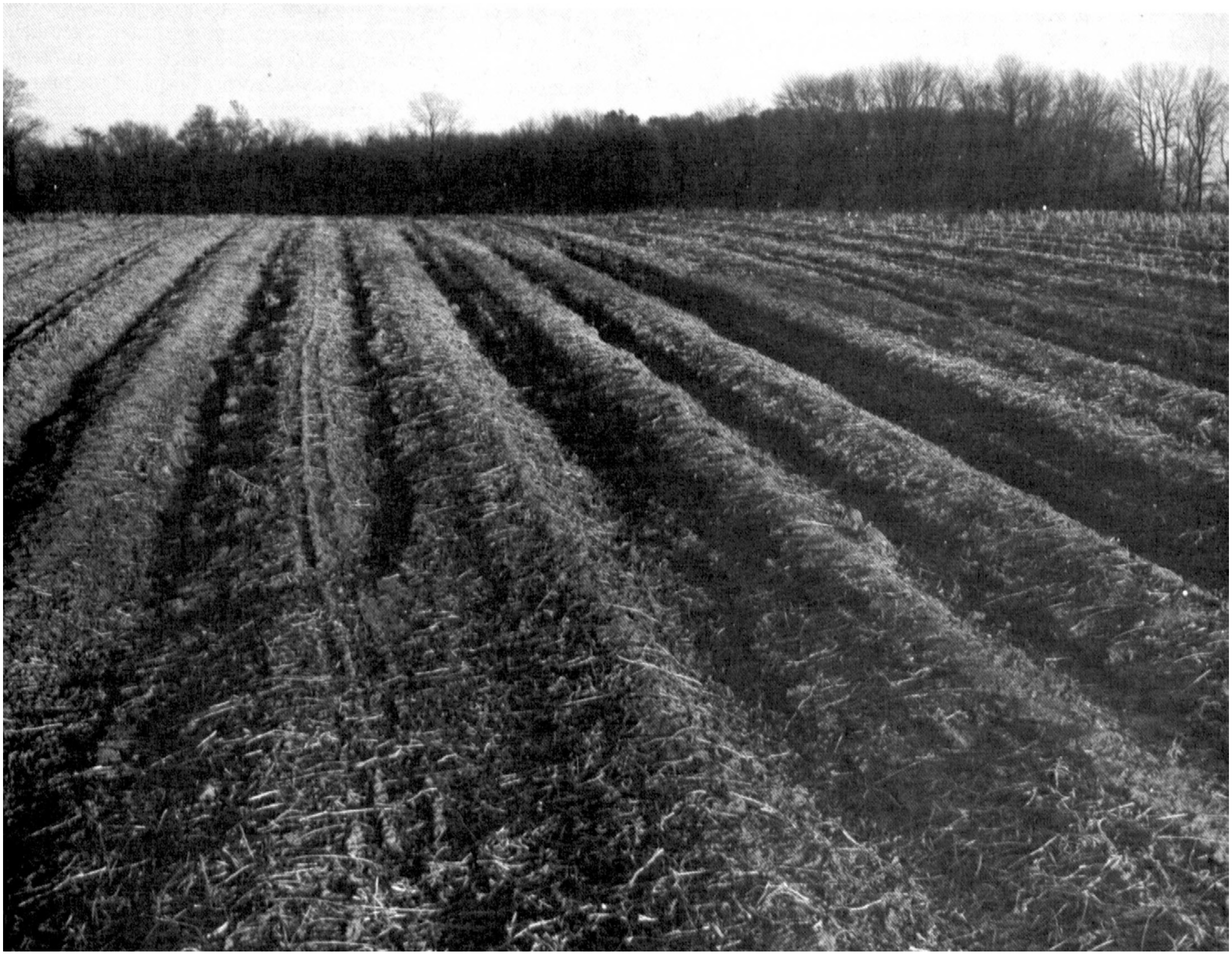

Figure 5.—Accelerated erosion on Miami silt loam, 2 to 6 percent slopes, eroded. Rills have formed between the rows.

Available water capacity is high in the Miami soil. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is rapid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as woodlots. A few are used as pasture or hayland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main management concern. The only cultivated crops grown should be small grain or crops that provide a protective cover most of the year. Small grain can be grown in rotation with hay or pasture. Measures that control erosion and surface runoff are needed if cultivated crops are grown. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses and legumes for hay and well suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and

poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the slope and the moderately slow permeability are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. Building local roads and streets on the contour helps to overcome the slope. Extensive road cuts may be necessary.

The land capability classification is IVe. The woodland ordination symbol is 1a.

MmE—Miami silt loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped or slightly elongated and are 3 to 75 acres in size. The dominant size is about 35 acres.

In a typical profile, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is dark yellowish brown, firm clay loam; the next part is brown, firm clay loam; and the lower part is

Figure 6.—A grassed waterway in an area of Miami silt loam, 2 to 6 percent slopes, eroded, used for corn.

yellowish brown, friable loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the depth to the loam substratum is less than 24 or more than 40 inches. In some eroded areas the surface layer is loam or clay loam. In places the subsoil has more clay or less sand. In some small areas the slope is less than 18 or more than 35 percent.

Available water capacity is moderate. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is very rapid. The surface layer is friable, but the slope hinders tillage.

Most areas are used as woodlots (fig. 7). A few are used as pasture or hayland. This soil is generally unsuited to corn, soybeans, and small grain because of the moderately steep and steep slopes.

This soil is generally unsuited to grasses and legumes for hay and poorly suited to pasture. A cover of grasses and legumes is effective in controlling erosion. The slope and the hazard of erosion are the main management concerns. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is fairly well suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Selective cutting of trees and construction of logging trails on the contour help to control erosion. Because the slope hinders the use of some machinery, special planting and harvesting equipment is needed. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Figure 7.—A wooded area of Miami silt loam, 18 to 35 percent slopes. Ockley silt loam, 0 to 2 percent slopes, is in the foreground.

Because the slope is a severe limitation, this soil is generally unsuitable as a site for dwellings. It is generally unsuited to septic tank absorption fields because the slope and the moderately slow permeability are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of the slope. Building on the contour helps to overcome the slope. Extensive earthmoving is needed to prepare roadways.

The land capability classification is VIIe. The woodland ordination symbol is 1r.

MoC3—Miami clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on side slopes, knolls, and breaks along drainageways in the uplands. Areas are irregularly shaped and are 3 to 35 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface is mixed dark brown and dark yellowish brown clay loam about 9 inches thick. The subsoil is dark yellowish brown, firm clay loam about 20 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam or silt loam. In other areas the loam substratum is at a depth of more than 40 inches. In some places the lower part of the subsoil is mottled. In other places the subsoil has more clay or less sand. In some small areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the moderately well drained Williamstown and Xenia soils on the less sloping parts of the landscape. These soils make up about 3 percent of the unit.

Available water capacity is moderate in the Miami soil. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is rapid. If tilled when too wet, the surface layer becomes cloddy and hard to work.

Most areas are used for cultivated crops. Some are used as pasture or hayland.

This soil is poorly suited to corn, soybeans, and small grain. Small grain can be grown in rotation with hay or pasture. Erosion is the main management concern. Measures that control erosion and surface runoff are needed if cultivated crops are grown. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses and legumes for hay and well suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing footings and foundations and backfilling with more stable material, such as sand and gravel, help to prevent the structural damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. Otherwise, extensive earthmoving may be needed to level the site sufficiently for construction. Erosion can be controlled by developing random lots rather than an extensive area and by retaining as much of the existing vegetation as possible. It also can be controlled by building roads on the contour, by establishing diversions between lots to intercept runoff, and by hauling in topsoil for use as the final layer and then reseeding as soon as possible with desired grasses.

Because of slope, frost action, and low strength, this soil is limited as a site for local roads and streets. Some road cuts may be necessary. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. An enlarged absorption field should be installed to help overcome this limitation.

The land capability classification is IVe. The woodland ordination symbol is 1a.

MoD3—Miami clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped and are 3 to 35 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is mixed dark brown and dark yellowish brown clay loam about 7 inches thick. The subsoil is dark yellowish brown, firm clay loam about 18 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam or silt loam. In other areas the loam substratum is at a depth of more than 40 inches. In some places the lower part of the subsoil is mottled. In other places the subsoil has more clay or less sand. In some small areas the slope is less than 12 or more than 18 percent.

Available water capacity is moderate. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is moderately low. Surface runoff is very rapid. If tilled when too wet, the surface layer becomes cloddy and hard to work.

Most areas are used for cultivated crops. Some are used as pasture or hayland. This soil is generally unsuited to corn, soybeans, and small grain because of a severe hazard of erosion.

This soil is poorly suited to grasses and legumes for hay but is suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the slope and the moderately slow permeability are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of the slope. Building on the contour helps to overcome the slope. Extensive road cuts may be necessary.

The land capability classification is VIe. The woodland ordination symbol is 1a.

MrA—Miami silt loam, gravelly substratum, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on slight rises in the uplands. Areas are irregular in shape and are 3 to 100 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The subsoil is about 29 inches thick. It is dark yellowish brown and friable. The upper part is silt loam, and the lower part is gravelly fine sandy loam. The substratum to a depth of 60 inches is yellowish brown, stratified gravelly sand and very gravelly coarse sand. In some areas the silt loam or silty clay loam layers are more than 20 inches thick. In some places the substratum is at a depth of more than 40 inches. In other places it is loam. In some small areas the lower part of the subsoil has a sandy clay loam or sandy loam layer. In other areas it is mottled. In places the subsoil has more clay or less sand. In some small areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Fincastle and moderately well drained Williamstown and Xenia soils on the slightly lower parts of the landscape. These soils make up about 5 percent of the unit.

Available water capacity is moderate in the Miami soil. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as hayland, pasture, or woodlots.

This soil is well suited to corn, soybeans, and small grain. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. Overgrazing and grazing when the soil is wet, however, cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Because of low strength, the soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic. The soil is moderately limited as a site for septic tank absorption fields because of the moderate permeability. An enlarged absorption field should be installed to overcome this limitation.

The land capability classification is I. The woodland ordination symbol is 1a.

MpB2—Miamian silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on rises and along drainageways on uplands. Areas are irregular in shape and are 3 to 75 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil is dark yellowish brown, firm clay and clay loam about 23 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas, the silt loam or silty clay loam layers are more than 20 inches thick and the loam

substratum is at a depth of more than 40 inches. In some places the subsoil has more sand or less clay, or both. In other places the lower part of the subsoil is mottled. In some eroded areas the surface layer is loam or clay loam. In other areas the loam substratum is within a depth of 20 inches. In some small areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby and moderately well drained Celina soils on the less sloping parts of the landscape. Also included are some areas of the poorly drained Patton and very poorly drained Treaty soils in depressions. Included soils make up about 4 percent of the unit.

Available water capacity is moderate in the Miamian soil, and permeability is moderately slow. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be tilled easily throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A cropping sequence that includes grasses and legumes, diversions, terraces, grassed waterways, contour farming, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Backfilling around foundations and footings with more stable material, such as sand and gravel, helps to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of frost action, this soil is moderately limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. An enlarged absorption field should be installed to help overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 1a.

MpC—Miamian silt loam, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped and are 5 to 25 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, friable silt loam, and the lower part is dark yellowish brown, firm clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the depth to the loam substratum is more than 40 inches. In other areas the lower part of the subsoil is mottled. In some places the subsoil has more sand or less clay, or both. In some eroded areas the surface layer is loam or clay loam. In some small areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the moderately well drained Celina soils on the less sloping parts of the landscape. Also included, near the major drainageways, are small areas of Eldean soils, which are underlain by sand and gravel. Included soils make up about 5 percent of the unit.

Available water capacity is high in the Miamian soil, and permeability is moderately slow. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as woodlots. A few are used as pasture or hayland.

This soil is fairly well suited to corn, soybeans, and small grain. Small grain can be grown in rotation with hay or pasture. Erosion is the main management concern. Measures that control erosion and surface runoff are needed if cultivated crops are grown. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management

concern. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Otherwise, extensive earthmoving may be needed to level the site sufficiently for construction. Erosion can be controlled by developing random lots rather than an extensive area and by retaining as much of the existing vegetation as possible. It also can be controlled by building roads on the contour, by establishing diversions between lots to intercept runoff, and by hauling in topsoil for use as the final layer and then reseeding as soon as possible with desired grasses.

Because of slope and frost action, this soil is moderately limited as a site for local roads and streets. Building on the contour helps to overcome the slope. Some road cuts may be necessary. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. An enlarged absorption field should be installed to help overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 1a.

MpD—Miamian silt loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped or slightly elongated and are 3 to 25 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark brown silt loam about 4 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is dark yellowish brown, firm clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas, the silt loam or silty clay loam layers are more than 20 inches thick and the loam substratum is at a depth of more than 40 inches. In other areas the subsoil has more sand or less clay, or both. In some eroded areas the surface layer is loam or clay loam. In some small areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of Eldean soils near the major drainageways. These soils are underlain by sand and gravel. They make up about 3 percent of the unit.

Available water capacity is high in the Miamian soil, and permeability is moderately slow. The organic matter content of the surface layer is moderate. Surface runoff is rapid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as woodlots. A few are used as pasture or hayland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main management concern. The only cultivated crops grown should be small grain or crops that provide a protective cover most of the year. Small grain can be grown in rotation with hay or pasture. Measures that control erosion and surface runoff are needed if cultivated crops are grown. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay and is well suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Selective cutting of trees and construction of logging trails on the contour help to control erosion. Because the slope hinders the use of some machinery, special planting and harvesting equipment is needed. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to building site development and to septic tank absorption fields. Overcoming this limitation is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of the slope. Building on the contour helps to overcome the slope. Extensive road cuts may be necessary.

The land capability classification is IVe. The woodland ordination symbol is 1r.

MpE—Miamian silt loam, 18 to 35 percent slopes. This moderately steep and steep, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped or slightly elongated and are 3 to 75 acres in size. The dominant size is about 35 acres.

In a typical profile, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil is about 30 inches thick. The upper part is brown, friable silt loam; the next part is dark yellowish brown, firm clay loam; and the lower part is yellowish brown, firm loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the loam substratum is at a depth of less than 24 or more than 40 inches. In other areas the subsoil has more sand or less clay, or both. In some eroded areas the surface layer is loam or clay loam. In some small areas the slope is less than 18 or more than 35 percent.

Included with this soil in mapping are small areas of Eldean soils near the major drainageways. These soils are underlain by sand and gravel. They make up about 3 percent of the unit.

Available water capacity is moderate in the Miamian soil, and permeability is moderately slow. The organic matter content of the surface layer is moderate. Surface runoff is very rapid. The surface layer is friable, but the slope hinders tillage.

Most areas are used as woodlots. A few are used as pasture or hayland. This soil is generally unsuited to corn, soybeans, and small grain because of the moderately steep and steep slopes.

This soil is poorly suited to grasses and legumes for hay but is suited to pasture. A cover of grasses and legumes is effective in controlling erosion. The slope and the hazard of erosion are the main management concerns. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is fairly well suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Selective cutting of trees and construction of logging trails on the contour help to control erosion. Because the slope hinders the use of some machinery, special planting and harvesting equipment is needed. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to building site development and to septic tank absorption fields. Overcoming this limitation is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads and streets because of the slope. Building on the contour helps to overcome the slope. Extensive road cuts may be necessary.

The land capability classification is VIIe. The woodland ordination symbol is 1r.

MuC3—Miamian clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on side slopes, knolls, and breaks along drainageways in the uplands. Areas are irregularly shaped and are 3 to 35 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is brown clay loam about 7 inches thick. The subsoil is dark yellowish brown, firm clay loam about 23 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam or silt loam. In other areas the loam substratum is at a depth of more than 40 inches. In places the lower part of the subsoil is mottled. In some small areas where the topsoil and subsoil have been completely or almost completely removed by erosion, the loamy substratum is at or near the surface. In places the subsoil has more sand or less clay, or both. In some small areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the moderately well drained Celina soils on the less sloping parts of the landscape. Also included, near the major drainageways, are small areas of Eldean soils, which are underlain by sand and gravel. Included soils make up about 3 percent of the unit.

Available water capacity is moderate in the Miamian soil, and permeability is moderately slow. The organic matter content of the surface layer is moderately low. Surface runoff is rapid. If tilled when too wet, the surface layer becomes cloddy and hard to work.

Most areas are used for cultivated crops. Some are used as pasture or hayland.

This soil is poorly suited to corn, soybeans, and small grain. Small grain can be grown in rotation with hay or pasture. Erosion is the main management concern (fig. 8). Measures that control erosion and surface runoff are needed if cultivated crops are grown. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss (fig. 9). Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay and is well suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth.

Figure 8.—An area of Miamian clay loam, 6 to 12 percent slopes, severely eroded.

Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting. Seedlings survive and grow well if competing vegetation is controlled.

Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The dwellings should be designed so that they conform to the natural slope of the land. Otherwise, extensive earthmoving may be needed to level the site sufficiently for construction. Erosion can be controlled by developing random lots rather than an extensive area and by retaining as much of the existing vegetation as possible. It also can be controlled by building roads on the contour, by establishing diversions between lots to intercept runoff, and by hauling in topsoil for use as the final layer and then reseeding as soon as possible with desired grasses.

Because of slope and frost action, this soil is moderately limited as a site for local roads and streets. Building on the contour helps to overcome the slope. Some road cuts may be necessary. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. An enlarged absorption field should be installed to help overcome this limitation.

The land capability classification is IVe. The woodland ordination symbol is 1a.

MuD3—Miamian clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on side slopes and breaks along drainageways in the uplands. Areas are irregularly shaped and are 3 to 35 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown clay loam about 6 inches thick. The subsoil is 20 inches thick. It is firm clay loam. The upper part is dark

Figure 9.—A grassed waterway in an area of Miamian clay loam, 6 to 12 percent slopes, severely eroded.

yellowish brown, and the lower part is yellowish brown. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the loam substratum is at a depth of more than 40 inches. In other areas the lower part of the subsoil is mottled. In places the subsoil has more sand or less clay, or both. In some small areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of Eldean soils near the major drainageways. These soils are underlain by sand and gravel. They make up about 3 percent of the unit.

Available water capacity is moderate in the Miamian soil, and permeability is moderately slow. The organic matter content of the surface layer is moderately low. Surface runoff is very rapid. If tilled when too wet, the surface layer becomes cloddy and hard to work.

Most areas are used for cultivated crops. Some are used for pasture or hayland. This soil is generally unsuited to corn, soybeans, and small grain because of the hazard of erosion.

This soil is poorly suited to grasses and legumes for hay and fairly well suited to pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Selective cutting of trees and construction of logging trails on the contour help to control erosion. Because the slope hinders the use of some machinery, special planting and harvesting equipment is needed. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled by spraying, cutting, or girdling.

Because the slope is a severe limitation, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the slope and the moderately slow permeability are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads because of the slope. Building on the contour helps to overcome the slope. Extensive road cuts may be necessary.

The land capability classification is VIe. The woodland ordination symbol is 1r.

Mx—Millsdale silty clay loam. This nearly level, moderately deep, very poorly drained soil is on stream terraces along the Flatrock River, Little Flatrock River, and Hurricane Creek in the southern part of the county. It is subject to ponding. Areas are irregular in shape or slightly elongated and are 3 to 40 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is about 14 inches thick. The upper part is very dark gray, firm silty clay loam, and the lower part is dark grayish brown, mottled, firm silty clay. The substratum is very pale brown channery silt loam that has many limestone fragments. Limestone bedrock is at a depth of about 28 inches. In some areas the depth to limestone is less than 20 or more than 40 inches. In other areas the surface layer is silt loam and is lighter colored.

Included with this soil in mapping are small areas of the well drained Milton soils in the higher landscape positions. These soils make up about 5 percent of the unit.

Available water capacity is low in the Millsdale soil, and permeability is moderately slow. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. If tilled when too wet, the surface layer becomes cloddy and hard to work. The soil has a water table at or above the surface during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is fairly well suited to corn and soybeans. The ponding and the low available water capacity are the main limitations. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. In some areas the depth to bedrock may hinder construction of the open ditches and installation of subsurface drains. Planting early in spring or planting early maturing crops, such as small grain, helps to prevent the adverse effects of drought in dry years. A conservation tillage system that leaves protective amounts of crop residue on the surface conserves moisture and improves or maintains tilth and the organic matter content.

This soil generally is well suited to grasses, such as bromegrass, and legumes, such as red clover, for hay or pasture, but it is not suited to deep-rooted legumes. The wetness and the low available water capacity are the main management concerns. A drainage system is needed. The rooting depth may be limited by the depth to bedrock. Overgrazing and grazing when the soil is too wet cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. The soil is fairly well suited to trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be

overcome by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the depth to bedrock, the ponding, and the shrink-swell potential are severe limitations, this soil is generally unsuitable for building site development. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads because of ponding, frost action, and low strength. Drainage ditches are needed along the roads to lower the water table and to help prevent the damage caused by frost action and ponding. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIIw. The woodland ordination symbol is 2w.

MzA—Milton silt loam, 0 to 3 percent slopes. This nearly level, moderately deep, well drained soil is on stream terraces along the Flatrock River, Little Flatrock River, and Hurricane Creek in the southern part of the county. Areas are irregular in shape or slightly elongated and are 3 to 25 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer also is dark grayish brown silt loam. It is about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, friable silt loam, and the lower part is dark yellowish brown, firm clay. Limestone bedrock is at a depth of about 28 inches. In some areas the depth to limestone is less than 20 or more than 40 inches. In other areas stratified sand and gravelly sand as much as 18 inches thick is above the limestone. In places the lower part of the subsoil is gravelly clay loam or gravelly loam. In some small areas the slope is more than 3 percent.

Included with this soil in mapping are small areas of the very poorly drained Millsdale soils in the lower landscape positions. These soils make up about 7 percent of the unit.

Available water capacity is low in the Milton soil, and permeability is moderately slow. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as hayland, pasture, or woodlots.

This soil is well suited to corn and small grain. Erosion and the low available water capacity are the main management concerns. Measures that control erosion and surface runoff are needed if the more sloping areas are used for cultivated crops. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface conserve moisture, help to control erosion, and improve or maintain tilth and the organic matter content. Planting early in spring or planting early maturing crops, such as small grain, helps to prevent the adverse effects of drought in dry years.

This soil is well suited to hay and pasture. Erosion and the low available water capacity are the main management concerns. The rooting depth may be limited because of the depth to bedrock. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the depth to bedrock, this soil is severely limited as a site for dwellings with basements and moderately limited as a site for dwellings without basements. The shallow depth to bedrock makes excavating for basements and footings difficult. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the depth to bedrock and the moderately slow permeability. It is generally unsuited to this use.

The land capability classification is IIe. The woodland ordination symbol is 2a.

OcA—Ockley silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces and outwash plains. Areas are irregularly shaped and are 3 to 400 acres in size. The dominant size is about 50 acres.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The subsoil is about 39 inches thick. The upper part is dark yellowish brown and dark brown, friable silt loam; the next part is dark brown, firm clay loam; and the lower part is dark brown and dark reddish brown, friable sandy clay loam and gravelly sandy clay loam. The substratum to a depth of 60 inches

is yellowish brown, stratified coarse sand and very gravelly coarse sand. In some areas the stratified sand and gravel is within a depth of 40 inches. In other areas, the subsoil has more clay and the soil is shallower to calcareous sand and gravel. In some places the lower part of the subsoil is mottled. In other places the substratum is loam. In some small areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils on the lower parts of the landscape. These soils make up about 6 percent of the unit.

Available water capacity is high in the Ockley soil. Permeability is moderate in the subsoil and very rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. The main concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing the foundations and footings and backfilling with sand and gravel help to prevent the structural damage caused by shrinking and swelling. Because of low strength and frost action, the soil is moderately limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic. The soil is suitable for septic tank absorption fields.

The land capability classification is I. The woodland ordination symbol is 1a.

OcB2—Ockley silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on terraces and outwash plains. Areas are elongated and are 3 to 15 acres in size. The dominant size is about 5 acres.

In a typical profile, the surface layer is brown silt loam about 12 inches thick. The subsoil is about 32 inches thick. It is dark yellowish brown and firm. The upper part is clay loam, the next part is sandy clay loam and gravelly sandy clay loam, and the lower part is gravelly clay. The substratum to a depth of 60 inches is yellowish brown, stratified coarse sand and very gravelly coarse sand. In some areas stratified sand and gravelly sand is within a depth of 40 inches. In other areas the subsoil has more clay. In some small severely eroded areas, the surface layer is clay loam. In some small areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils on the lower parts of the landscape. These soils make up about 5 percent of the unit.

Available water capacity is moderate in the Ockley soil. Permeability is moderate in the subsoil and very rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Properly designing the foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion. Because of low strength and frost

action, the soil is moderately limited as a site for local roads and streets. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic. The soil is suitable for septic tank absorption fields.

The land capability classification is IIe. The woodland ordination symbol is 1a.

Pn—Patton silty clay loam. This nearly level, deep, poorly drained soil is in broad depressional areas on lake plains. It is subject to ponding. Areas are irregular in shape and are 10 to 200 acres in size. The dominant size is about 60 acres.

In a typical profile, the surface layer is very dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 27 inches thick. The upper part is dark gray, mottled, firm silty clay loam, and the lower part is gray, mottled, firm silt loam. The substratum to a depth of 60 inches is gray and yellowish brown, mottled silt loam and stratified silt loam and sand. In some areas the surface layer is silt loam. In other areas the substratum is at a depth of more than 40 inches. In some places the subsoil has more clay or less sand, or both. In other places the substratum has thin strata of fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby and well drained Miamian soils on the higher parts of the landscape. These soils make up about 10 percent of the unit.

Available water capacity is very high in the Patton soil, and permeability is moderately slow. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. If tilled when too wet, the surface layer becomes cloddy and hard to work. The soil has a water table at or above the surface during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn and soybeans. The ponding is the main management concern. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these (fig. 10). A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as red clover, for hay or pasture. The wetness is the main management concern. A drainage system is needed. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, and timely deferment of grazing help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is suited to wetland species of trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be overcome by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the ponding is a severe hazard, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the ponding and the moderately slow permeability are severe limitations. The soil is severely limited as a site for local roads because of ponding, frost action, and low strength. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 2w.

Px—Pits, quarry. This nearly level to very steep map unit is on outwash terraces. The pits were formed when limestone was mined from areas of Milton and Millsdale soils (fig. 11). Areas are rectangular or irregular in shape and are 3 to 50 acres in size. The dominant size is about 20 acres.

In a typical area of Pits, quarry, the original soil and some of the limestone substratum have been removed. Limestone bedrock is at the surface. Some areas are covered by a mixture of soil and rock material. Included in mapping are small areas of water.

Most areas are idle and support no vegetation. In some areas limestone is being mined. A few areas are used for recreation.

This unit is generally unsuited to agricultural uses and to woodland. Before it can be used for these purposes, extensive renovation is needed. The unit is generally unsuited to building site development and sanitary facilities.

No land capability classification or woodland ordination symbol is assigned.

RuB—Russell silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is in areas around drainageways on uplands. Areas are irregularly shaped and are 3 to 40 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The subsoil is about 39 inches

Figure 10.—An open ditch in an area of Patton silty clay loam. Open ditches provide outlets for subsurface water.

thick. The upper part is brown, friable silt loam; the next part is dark yellowish brown, friable silty clay loam; and the lower part is dark yellowish brown, firm and friable clay loam. The substratum to a depth of 60 inches is brown loam. In some areas the silt loam and silty clay loam layers are less than 20 inches thick, and in other areas they are more than 40 inches thick. In places the subsoil has more sand or clay. In some small areas the lower part of the subsoil is mottled. In some small eroded areas the subsoil has been mixed with the surface soil by plowing. In some small areas the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Fincastle soils on flats or on the more nearly level parts of the landscape. Also included are small areas of the moderately well drained Xenia soils on short, steep slopes along drainageways and in the lower landscape positions. Included soils make up about 4 percent of the unit.

Available water capacity is high in the Russell soil, and permeability is moderate. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help

to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings (fig. 12). Properly designing foundations and footings and backfilling with more stable material, such as sand and gravel, help to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets.

Figure 11.—Limestone mining in an area of Pits, quarry. The original soils in this area were Millsdale silty clay loam and Milton silt loam, 0 to 3 percent slopes.

Figure 12.—Homesite development in an area of Russell silt loam, 2 to 6 percent slopes.

Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is moderately limited as a site for septic tank absorption fields because of the moderate permeability. Increasing the size of the absorption field can help to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 1a.

Sh—Shoals silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on bottom land near large streams. It is frequently flooded for brief periods during winter and spring. Areas are elongated and are 3 to 80 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown and brown, mottled, friable silt loam, and the lower part is dark grayish brown and yellowish brown, mottled, friable loam. The upper part of the substratum is yellowish brown, mottled loam. The lower part to a depth

of 60 inches is light brownish gray, mottled, stratified loamy sand, sandy loam, sand, and gravelly sand. In some areas the surface layer is darker or is loam. In some small areas sandy clay loam or clay loam is below a depth of 36 inches. In other small areas dense loam that contains free carbonates is below a depth of 36 inches.

Included with this soil in mapping are small areas of the very poorly drained Sloan soils in the slightly lower landscape positions. Also included are small areas of the well drained Genesee and Stonelick soils in the slightly higher landscape positions. Included soils make up about 5 percent of the unit.

Available water capacity is high in the Shoals soil, and permeability is moderate. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 0.5 foot to 1.5 feet during winter and spring.

Most areas are used as pasture or woodlots. Some are used for cultivated crops.

This soil is poorly suited to corn and soybeans. It also is poorly suited to small grain because flooding usually destroys the stands unless they are protected. Wetness and flooding during winter and spring are the main management concerns. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. Selecting crops that can be planted and grown during periods when flooding is less frequent reduces the likelihood of crop damage. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is fairly well suited to legumes for hay or pasture. Wetness and flooding are the main management concerns. A drainage system and protection from flooding are necessary. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Many areas are used as woodlots. This soil is well suited to trees. The main management concerns are the equipment limitation and seedling mortality. Harvesting is usually delayed until dry periods or periods when the ground is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling.

Because the flooding and the wetness are severe limitations, this soil is generally unsuited to building site development and to septic tank absorption fields. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads because of wetness, flooding, and frost action. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action and wetness. Building the roads up above the normal flood stage helps to prevent the damage caused by floodwater. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IVw. The woodland ordination symbol is 2w.

Sm—Sleeth silt loam. This nearly level, deep, somewhat poorly drained soil is on terraces and outwash plains. Areas are irregularly shaped and are 3 to 150 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, mottled, firm silty clay loam; the next part is grayish brown, mottled, firm silty clay loam and silt loam; and the lower part is grayish brown, mottled, firm and friable sandy clay loam and gravelly sandy clay loam. The substratum to a depth of 60 inches is yellowish brown coarse sand and gravelly coarse sand. In some areas the sand and gravel is within a depth of 40 inches. In other areas the surface is loam. In places the substratum is stratified silt loam, sand, and silt.

Included with this soil in mapping are small areas of the well drained Eldean and Ockley soils on the slightly higher rises. Also included are small areas of the very poorly drained Westland soils in depressions. Included soils make up about 5 percent of the unit.

Available water capacity is moderate in the Sleeth soil. Permeability is moderate in the subsoil and very rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 1 to 3 feet during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. The wetness is the main management concern. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as red clover, for hay or pasture. The wetness is the main management concern. A drainage system is needed. Other concerns are

overgrazing and grazing when the soil is too wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because the wetness is a severe limitation, this soil is generally unsuited to building site development and to septic tank absorption fields. It is severely limited as a site for local roads because of frost action and low strength. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 3a.

So—Sloan silt loam, frequently flooded. This nearly level, deep, very poorly drained soil is in depressions on bottom land along the larger streams. It is frequently flooded for brief periods during winter and spring (fig. 13). Areas are irregular in shape or elongated and are 3 to 500 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface soil is very dark grayish brown silt loam about 13 inches thick. The subsoil is mottled loam about 32 inches thick. The upper part is dark gray and firm, and the lower part is gray and friable. The substratum to a depth of 60 inches is yellowish brown, mottled loam and stratified loam and sandy loam. In some areas the dark surface soil is thinner. In other areas a thin layer of lighter colored silt loam overwash is at the surface. In places the substratum has strata of sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals and well drained Genesee and Stonelick soils on the higher parts of the landscape. These soils make up about 5 percent of the unit.

Available water capacity is high in the Sloan soil, and permeability is moderately slow. The organic matter content of the surface layer is high. Surface runoff is very slow. If tilled when too wet, the surface layer becomes cloddy and hard to work. The soil has a water table at or near the surface during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is fairly well suited to corn and soybeans. It is poorly suited to small grain because flooding usually destroys the stands unless they are protected. Wetness and flooding during winter and spring are the main management concerns. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. Selecting crops that can be planted and grown during periods when flooding is less frequent reduces the likelihood of crop damage. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses, such as reed canarygrass, and legumes, such as birdsfoot trefoil, for hay or pasture. Wetness and flooding are the main management concerns. Protection from flooding and a drainage system are necessary. Other concerns are overgrazing and grazing when the soil is too wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is fairly well suited to wetland species of trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be overcome by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the flooding and the wetness are severe limitations, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the flooding, the wetness, and the moderately slow permeability are severe limitations. Overcoming these limitations is generally not feasible, and a better suited soil should be selected for these uses. The soil is severely limited as a site for local roads because of low strength, wetness, and flooding. The roads should be built up above the normal flood stage. Drainage ditches and culverts help to lower the water table and help to prevent the damage caused by floodwater. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIIw. The woodland ordination symbol is 2w.

St—Stonelick sandy loam, frequently flooded. This nearly level, deep, well drained soil is on bottom land near the Flatrock River in the southern part of the county. It is frequently flooded for very brief periods during winter and spring. Areas are elongated and are 50 to 100 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface layer is very dark grayish brown sandy loam about 12 inches thick. The

Figure 13.—Flooding in an area of Sloan silt loam, frequently flooded.

upper part of the substratum is brown sandy loam. The next part is yellowish brown gravelly sandy loam. The lower part to a depth of 60 inches is brown gravelly coarse sandy loam that has flagstones. In some areas limestone bedrock is within a depth of 60 inches. In other areas stratified sand and gravelly sand is in the substratum. In some places the subsoil has less sand. In other places flagstones are throughout the profile.

Included with this soil in mapping are small areas of the very poorly drained Sloan and somewhat poorly drained Shoals soils. These soils are in the lower landscape positions or near areas where small drainageways outlet into the larger stream bottoms. They make up about 5 percent of the unit.

Available water capacity is low in the Stonelick soil, and permeability is moderately rapid. Organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and can be tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is fairly well suited to corn and soybeans. It is poorly suited to small grain because flooding usually destroys the stands unless they are protected. Flooding during the winter and spring and the low available water capacity

Figure 14.—An area of Treaty silty clay loam. The included Crosby soils are in the lighter colored areas.

are the main limitations. Selecting crops that can be planted and grown during periods when flooding is less frequent reduces the likelihood of crop damage. Irrigation helps to prevent the crop damage caused by drought. A conservation tillage system that leaves protective amounts of crop residue on the surface conserves moisture and improves or maintains the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Wetness, the low available water capacity, and flooding are the main management concerns. Protection from flooding and irrigation during dry periods are necessary. Other concerns are overgrazing or grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because the flooding is a severe hazard, this soil is generally unsuited to building site development and to septic tank absorption fields. It is severely limited as a site for local roads because of the flooding. Building the road up above the normal flood stage and installing culverts help to prevent the damage caused by floodwater.

The land capability classification is IIIw. The woodland ordination symbol is 2a.

Tr—Treaty silty clay loam. This nearly level, deep, very poorly drained soil is in broad depressional areas and narrow drainageways on uplands (fig. 14). It is subject to ponding. Areas are irregular in shape or fingerlike and are 3 to 400 acres in size. The dominant size is about 35 acres.

In a typical profile, the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is

about 37 inches thick. The upper part is gray, mottled, firm silty clay loam, and the lower part is gray, mottled, firm and friable clay loam and loam. The substratum to a depth of 60 inches is brown, mottled loam. In some areas the silty clay loam layers are less than 40 or more than 60 inches thick. In other areas the soil has thin layers of lighter colored material, which has washed in from surrounding soils. In some places, the silty cap is thicker and the lower part of the subsoil has less sand. In other places the subsoil has more sand or less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Crosby and well drained Miamian soils on the slightly convex higher parts of the landscape. These soils make up about 5 percent of the unit.

Available water capacity is high in the Treaty soil. Permeability is moderate in the subsoil and moderately slow in the substratum. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. If tilled when too wet, the surface layer becomes cloddy and hard to work. The soil has a water table at or above the surface during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn and soybeans. The ponding is the main hazard (fig. 15). If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. The ponding is the main management concern. A drainage system is needed. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment

Figure 15.—Corn damage caused by ponding on Treaty silty clay loam.

of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is fairly well suited to wetland species of trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be overcome by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the ponding is a severe hazard, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because the ponding and the moderately slow permeability are severe limitations. The soil is severely limited as a site for local roads because of ponding, frost action, and low strength. Drainage ditches along the roads help to lower the water table and help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 2w.

Ws—Westland clay loam. This nearly level, deep, very poorly drained soil is in broad depressional areas on terraces and outwash plains. It is subject to ponding. Areas are irregular in shape or fingerlike and are 3 to 400 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface layer is dark brown clay loam about 11 inches thick. The subsoil is about 43 inches thick. The upper part is very dark gray and grayish brown, mottled, firm clay loam, and the lower part is light gray, mottled, friable gravelly loam. The substratum to a depth of 60 inches is grayish brown gravelly coarse sand and coarse sand. Some small areas have received less than 20 inches of light colored silt loam overwash. In some areas the subsoil has less sand or less clay. In some places it is silt loam or silty clay loam, and in other places it does not have gravel in the lower part. In places stratified sand and gravel is within a depth of 40 inches. In some areas the substratum is stratified sand and silt loam, and in other areas it is loam.

Included with this soil in mapping are small areas of the well drained Eldean and Ockley and somewhat poorly drained Sleeth soils on the higher rises. These soils make up 5 to 10 percent of the unit.

Available water capacity is high in the Westland soil. Permeability is moderate in the subsoil and very rapid in the substratum. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. If tilled when too wet, the surface layer becomes too cloddy and hard to work. The soil has a water table at or above the surface during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn and soybeans. The ponding is the main hazard. If the soil is adequately drained, row crops can be included in the cropping sequence in most years. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface improves or maintains tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. The wetness is the main management concern. A drainage system is needed. Other concerns of management are overgrazing and grazing when the soil is wet, both of which cause surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is fairly well suited to wetland species of trees. The main management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation can be overcome by delaying timber harvest until dry periods or until the soil is frozen. Planting more trees than is necessary can compensate for seedling mortality, but thinning may be needed later. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because the ponding is a severe hazard, this soil is generally unsuited to building site development and to septic tank absorption fields. It is severely limited as a site for local roads because of ponding, frost action, and low strength. Drainage ditches along the roads help to lower the water table and help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 2w.

WwB2—Williamstown silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on small rises or in areas around drainageways on uplands. Areas are irregularly shaped and are 3 to 60 acres in size. The dominant size is about 10 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is firm clay loam about 21 inches thick. The upper part is dark yellowish brown, and the lower part is dark yellowish brown and yellowish brown and is mottled. The substratum to a depth of 60 inches is yellowish brown, mottled loam. In some areas the silt loam or silty clay loam layers are more than 20 inches thick, and in other areas the loam substratum is at a depth of more than 40 inches. In places the subsoil has less sand or more clay, or both. In some small severely eroded areas, the surface layer is clay loam. In other small areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the well drained Miami soils in the higher, more sloping landscape positions or on the side slopes along drainageways. Also included are small areas of the poorly drained Cyclone and somewhat poorly drained Fincastle soils in the low landscape positions.

Available water capacity is moderate in the Williamstown soil. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 1.5 to 3.5 feet during winter and spring.

Most areas are used for cultivated crops. Some are used as pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A cropping sequence that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay or pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. An adequate drainage system is needed to lower the water table and keep the wetness from becoming a problem. Water moves slowly to drainage systems because of the moderately slow permeability. Dwellings should be constructed without basements. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. In areas where commercial sewers are not available, an enlarged absorption field should be installed. The water table should be lowered by an adequate subsurface drainage system in combination with storm sewers.

The land capability classification is IIe. The woodland ordination symbol is 1a.

XeB—Xenia silt loam, 1 to 4 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on small rises and gentle breaks along drainageways in the uplands. Areas are irregularly shaped and are 3 to 120 acres in size. The dominant size is about 25 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is about 40 inches thick. The upper part is dark yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown and yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the silt loam and silty clay loam layers are less than 20 inches thick, and in other areas they are more than 40 inches thick. In some places the subsoil has more sand. In other places the loam substratum is within a depth of 40 inches. In some small eroded areas the subsoil has been mixed with the surface layer by plowing. In other small areas the slope is less than 1 or more than 4 percent.

Included with this soil in mapping are small areas of the poorly drained Cyclone and somewhat poorly drained Fincastle soils in the lower landscape positions or in drainageways. Also included are small areas of the well drained Miami and Russell soils in the higher, more sloping landscape positions or on the side slopes along drainageways. Included soils make up about 6 percent of the unit.

Available water capacity is high in the Xenia soil, and permeability is moderately slow. The organic matter

content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The soil has a water table at a depth of 2 to 6 feet during winter and spring.

Most areas are used for cultivated crops. Some are used for pasture, hayland, or woodlots.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A cropping sequence that includes grasses and legumes, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a conservation tillage system that leaves protective amounts of crop residue on the surface help to control erosion and improve or maintain tilth and the organic matter content.

This soil is well suited to grasses, such as bromegrass, and legumes, such as alfalfa, for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. Erosion is the main management concern. Other concerns are overgrazing and grazing when the soil is wet, both of which cause surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Very few areas are used as woodland. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the wetness and the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Foundation drains are needed on sites for dwellings with basements. Properly designing foundations and footings and backfilling with more stable material, such as sand and gravel, help to prevent the structural damage caused by shrinking and swelling. Retaining as much of the existing vegetation as possible during construction helps to control erosion. Stockpiling topsoil, using it as the final layer, and then reseeding as soon as possible with desired grasses also help to control erosion.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Drainage ditches along the roads help to lower the water table and thus help to prevent the damage caused by frost action. Strengthening the base with better suited material improves the capacity of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. In areas where commercial sewers are not available, an enlarged absorption field should be installed to help overcome the moderately slow permeability of the subsoil. The water table should be lowered by an adequate subsurface drainage system in combination with storm sewers.

The land capability classification is IIe. The woodland ordination symbol is 1a.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to economically produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 235,750 acres in Rush County, or nearly 90 percent of the total acreage, meets the soil requirements for prime farmland. About 168,000 acres of this prime farmland is used for crops, mainly corn, soybeans (fig. 16), and small grain. The crops grown on this land account for more than 90 percent of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 6. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5.

Figure 16.—Soybeans in an area of Treaty silty clay loam and Crosby silt loam, 0 to 3 percent slopes. These soils make up a large part of the prime farmland in Rush County.

The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 6. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Joe Duke, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967, about 232,713 acres in Rush County was used for crops and pasture. Of this total, 142,457 acres was used for row crops, mainly corn and soybeans; 28,000 acres for close-grown crops, mainly wheat and oats; 32,872 acres for rotation hay and pasture; and 15,450 acres for permanent pasture. The rest was idle cropland or was used for conservation purposes (*3*).

The potential of the soils in Rush County for increased production of food is good. About 10,500 acres of potentially good cropland is currently used as woodland and about 12,232 acres as pasture (*3*). In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

The soils and climate of the survey area are well suited to most of the crops that are commonly grown in the county and to some specialty crops, such as strawberries, tomatoes, peas, beans, and potatoes, which are not commonly grown.

Deep, well drained soils that warm up early in the spring are especially well suited to many vegetables and small fruits. Examples are the Ockley, Russell, Miamian, and Miami soils that have a slope of less than 6 percent. Crops can generally be planted and harvested earlier on these soils than on the other soils in the county.

Most of the well drained soils are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

The latest information about growing crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

The main concerns in managing the cropland and pasture in Rush County are drainage, erosion and soil blowing, and fertility and tilth.

Soil drainage is the major problem on about 70 percent of the cropland and pasture in Rush County (*3*). The very poorly drained soils, such as Treaty, Sloan, and Westland soils, generally have been adequately drained for agricultural production. A few areas of these soils, however, cannot be economically drained. These are depressional areas where drainage ditches to a suitable outlet would have to be deep and would have to extend for great distances. Unless artificially drained, the somewhat poorly drained Crosby, Fincastle, Shoals, and Sleeth soils are so wet that crops are damaged during most years.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of a surface drainage system and tile drainage generally is needed if the very poorly drained soils are intensively row cropped. The drains should be more closely spaced in slowly permeable soils than in more permeable soils. Tile drainage is slow in Crosby soils because they have a slowly permeable subsoil.

Soil erosion is the major problem on about 21 percent of the cropland and pasture in Rush County (*3*). If the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Russell and Miamian soils, and on soils that have a layer in or below the subsoil that limits the depth of the root zone. An example of this layer is the bedrock underlying Milton soils. Erosion reduces productivity even more on soils that tend to be droughty, such as Eldean soils. If the subsoil is clayey and most of the topsoil has been lost, preparing a good seedbed and tilling are difficult. Second, soil erosion results in the pollution of streams by sediment. Control of erosion minimizes this pollution and improves water quality for municipal use, for recreation, and for fish and wildlife.

Erosion-control measures provide a protective cover, reduce the runoff rate, and increase the infiltration rate. A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, where part of the acreage is used for pasture and hay, including legumes and grasses in the cropping sequence helps to control erosion on sloping land. The grasses and legumes also provide nitrogen and improve tilth for the following crop.

Slopes are so short and irregular that contour farming or terracing is not practical on some sloping soils in Rush County. On these soils conservation tillage or a cropping system that provides a substantial vegetative cover is needed to control erosion. Conservation tillage practices that leave crop residue on the surface increase the infiltration rate and reduce the hazards of runoff and erosion. No-tillage in areas used for corn, which is common on an increasing acreage, is effective in controlling erosion on many soils. It is not so successful, however, on severely eroded soils that have a clayey surface layer.

Parallel tile outlet terraces shorten the length of slopes and thus are effective in controlling sheet, rill, and gully erosion. They are most effective on deep, well drained soils that are highly susceptible to erosion. The benefits of terracing include a reduction in soil loss and the associated loss of fertilizer elements; a reduction in the extent of sedimentation, which damages crops and watercourses; and a reduced need for grassed waterways, which take productive land out of row crops. Terracing also facilitates contour farming, which reduces the amount of pesticides entering watercourses. Many areas of Miami and Russell soils are suitable for terracing. Soils that have bedrock within a depth of 40 inches and soils that have a clayey subsoil are less well suited to terraces and diversions than other soils.

Grassed waterways are needed in many sloping areas, such as some areas of Miami and Russell soils, and in the many areas where a large watershed drains across Crosby and Treaty soils. A subsurface drainage system generally is needed if the waterways are established on Crosby and Treaty soils. Also, tile drainage is needed in the waterways established in the many seepy areas of Miami and Russell soils along drainageways.

Because of the large number of open ditches in the county, many grade stabilization structures are needed. These structures help to control erosion in areas where surface water drains into an open ditch. They also commonly are needed in open ditches where, because of the grade, the water moves so rapidly that erosion is a problem on the sides and bottom of the channels.

Soil blowing is a hazard on fall plowed soils in Rush County. It can be controlled by maintaining a plant cover, surface mulch, or a rough surface through proper tillage methods. Windbreaks of adapted trees and shrubs also are effective in controlling soil blowing.

Information about the erosion-control and drainage measures suitable for each kind of soil can be obtained at the local office of the Soil Conservation Service.

Soil fertility is affected by the content of plant nutrients and by reaction. Plants on all of the soils in the county respond well to nitrate, phosphate, and potash fertilizers. The soils are dominantly medium acid to mildly alkaline. If corn or soybeans are grown on medium acid soils, such as Sleeth soils, applications of ground limestone are needed to raise the pH. On all soils the amount of lime and fertilizer to be applied should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help to determine the kind and amount of fertilizer and lime needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Many of the soils used for crops in the county have a silt loam surface layer that is dark and has a moderate organic matter content. Generally, the structure of these soils is moderate to weak, and intense rainfall causes surface crusting. In some areas the crust is hard when dry and thus is impervious to water. The hard crust decreases the infiltration rate and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve soil structure and help to prevent crusting.

Tilth is a problem in areas where a clayey subsoil is exposed as a result of severe erosion. Conservation practices are needed in these areas to control erosion and improve tilth. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth in these areas.

Tilth also is a problem in the dark Treaty, Patton, Sloan, and Westland soils, which often stay wet until late in the spring. If plowed when wet, these soils tend to be very cloddy when dry. As a result, preparing a seedbed is difficult. A subsurface drainage system commonly improves tilth in these soils.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 7. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States,

shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 8. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Virgin forest once covered almost all of Rush County. The trees have been cleared from most of the land suitable for cultivation. The soils in many of the remaining areas of woodland are too steep for farming. They can produce trees of high quality if the woodland is properly managed.

About 18,000 acres in the county, or 7 percent of the total acreage, is woodland. Nearly all of the woodland is privately owned. The largest wooded areas are in the Miami-Xenia-Russell and Miamian map units (fig. 17). These units are described under the heading "General Soil Map Units." The most common trees are hickory, white oak, northern red oak, yellow-poplar, and sugar maple.

Much of the existing commercial woodland can be improved by the removal of undesirable trees. Open areas that are created during the removal of these trees should be planted to the more desirable species unless natural regeneration can establish productive stands. Measures that protect the woodland from grazing are needed. The Indiana Department of Natural Resources,

Figure 17.—A wooded area of the Miami-Xenia-Russell map unit.

Division of Forestry, can help to determine specific woodland management needs.

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *a* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a

site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features

that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, lovegrass, bromegrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, broom sedge, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, beech, wild cherry, sweetgum, willow, apple, black walnut, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, pondweed, spikerush, wild millet, wildrice, algae, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, woodchuck, coyote, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Edge habitat is the areas where major land uses or cover types adjoin. A good example is the border between dense woodland and a field of no-till corn. Although not rated in the table, edge habitat is of primary importance to animals from the smallest songbirds to white-tailed deer. Most of the animals that inhabit openland or woodland habitat also frequent edge habitat, and desirable edge areas are consistently used by 10 times as many wildlife as are the centers of large areas of woodland or cropland.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to

bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant

increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil

properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in

construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment (fig. 18). Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is

Figure 18.—A farm pond in an area of moderately sloping and strongly sloping Miami soils. Farm ponds can help to protect the soils downstream against overflow and can provide recreational opportunities.

subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

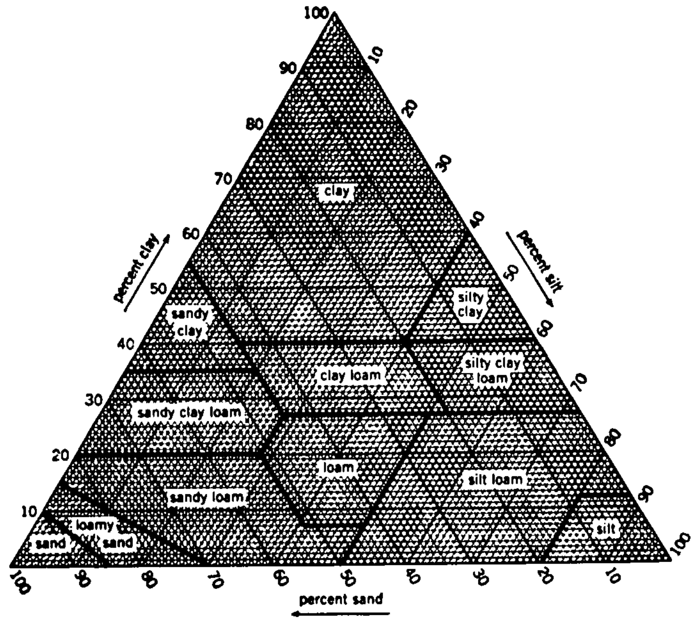

Figure 19.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 19). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*5*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Celina Series

The Celina series consists of deep, moderately well drained soils on uplands. These soils are moderately slowly permeable. They formed in loess and in the underlying glacial till. Slopes range from 2 to 6 percent.

Celina soils are similar to Williamstown soils and are adjacent to Crosby, Cyclone, and Miamian soils. Williamstown soils have more sand and less clay in the subsoil than the Celina soils. Crosby soils have a mottled subsoil. They are in the slightly lower landscape positions. Cyclone soils have a surface layer that is thicker and darker than that of the Celina soils and are

gray throughout the subsoil. They are in depressions. Miamian soils are not mottled in the lower part of the subsoil. They are in the higher, more sloping areas or on side slopes along drainageways.

Typical pedon of Celina silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 660 feet north and 700 feet east of the southwest corner of sec. 13, T. 15 N., R. 8 E.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine and very fine roots; slightly acid; abrupt smooth boundary.

Bt1—7 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; many fine and very fine roots; thin discontinuous brown (10YR 4/3) clay films on faces of peds; thin discontinuous light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt2—12 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common fine and very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) iron and manganese oxide accumulations; about 1 percent gravel; strongly acid; clear wavy boundary.

2Bt3—16 to 27 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2BC—27 to 32 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; about 5 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2C—32 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; about 3 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The loess cap is 0 to 18 inches thick. The depth to free carbonates is 18 to 40 inches. The upper part of the B horizon is very strongly acid to neutral, and the lower part is slightly acid to mildly alkaline. The content of gravel in the 2B horizon is 2 to 10 percent.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

Crosby Series

The Crosby series consists of deep, somewhat poorly drained soils on uplands. These soils are slowly permeable. They formed in loess and in the underlying glacial till. Slopes range from 0 to 3 percent.

Crosby soils are similar to Fincastle soils and are adjacent to Celina, Miamian, Patton, and Treaty soils. Fincastle soils have less clay in the subsoil than the Crosby soils. Celina and Miamian soils do not have mottles in the upper part of the subsoil. They are in the higher positions on the landscape. Patton and Treaty soils have a mollic epipedon, are gray throughout the subsoil, and are in depressions.

Typical pedon of Crosby silt loam, 0 to 3 percent slopes, in a cultivated field; 860 feet south and 1,220 feet west of the northeast corner of sec. 11, T. 15 N., R. 9 E.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine and very fine roots; neutral; abrupt smooth boundary.

BA—11 to 14 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct brown (10YR 4/3) mottles; moderate fine subangular blocky structure; friable; common fine and very fine roots; neutral; clear wavy boundary.

2Bt1—14 to 25 inches; brown (10YR 4/3) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

2Bt2—25 to 30 inches; brown (10YR 4/3) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; few very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

2Bt3—30 to 36 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2C—36 to 60 inches; brown (10YR 5/3) loam; common medium faint grayish brown (10YR 5/2) mottles; massive; friable; about 8 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The loess cap ranges from 0 to 18 inches in thickness.

The Ap horizon is silt loam or loam. The 2Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is medium acid to neutral.

Cyclone Series

The Cyclone series consists of deep, poorly drained soils in depressional areas on uplands. Permeability is moderate in the subsoil and moderately slow in the substratum. These soils formed in loess and in the underlying glacial till. Slopes range from 0 to 2 percent.

Cyclone soils are similar to Treaty soils and are adjacent to Celina, Fincastle, Williamstown, and Xenia soils. Treaty soils have a loess cap that is thinner than that of the Cyclone soils and contain more sand in the lower part of the subsoil. Celina, Fincastle, and Xenia soils have a surface layer that is lighter colored than that of the Cyclone soils and are not gray throughout the subsoil. They are in the higher positions on the landscape. Williamstown soils have a surface layer that is thinner and lighter colored than that of the Cyclone soils. They are in the higher areas.

Typical pedon of Cyclone silty clay loam, in a cultivated field; 75 feet north and 25 feet west of the southeast corner of sec. 22, T. 12 N., R. 10 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine and very fine roots; neutral; abrupt smooth boundary.

Btg1—10 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; common fine and very fine roots; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds; few fine black (N 2/0) iron and manganese accumulations; neutral; clear wavy boundary.

Btg2—18 to 22 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin continuous very dark gray (10YR 3/1) clay films on faces of peds; neutral; clear wavy boundary.

Btg3—22 to 36 inches; gray (10YR 5/1) silty clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; thin continuous gray (5Y 5/1) clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btg4—36 to 46 inches; gray (10YR 6/1) silty clay loam; many medium distinct brownish yellow (10YR 6/8) mottles; moderate coarse subangular blocky structure; firm; thin continuous gray (10YR 5/1) clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btg5—46 to 54 inches; gray (10YR 6/1) silty clay loam; many medium distinct brownish yellow (10YR 6/8) mottles; moderate coarse subangular blocky structure; firm; about 1 percent gravel; mildly alkaline; clear smooth boundary.

2BCg—54 to 68 inches; gray (10YR 6/1) loam; many medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; friable; about 5 percent gravel; strong effervescence; moderately alkaline; clear smooth boundary.

2C—68 to 80 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; friable; about 8 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 50 to 75 inches in thickness. The loess cap is 40 to 60 inches thick. The mollic epipedon is 10 to 18 inches thick.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or silt loam. It is neutral or slightly acid. The Bt horizon has hue of 10YR, value of 3 to 6, and chroma of 1. It is mildly alkaline to slightly acid. The 2BC horizon has hue of 10YR, value of 4 to 6, and chroma of 1. It is neutral to moderately alkaline.

Eldean Series

The Eldean series consists of well drained soils that are moderately deep over sand and gravel. These soils formed in glacial outwash on terraces, outwash plains, and end moraines. Permeability is moderate in the subsoil and rapid in the substratum. Slopes range from 2 to 18 percent.

Eldean soils are similar to Ockley soils and are adjacent to Sleeth and Westland soils. Ockley soils are deeper to calcareous sand and gravel than the Eldean soils and have less clay in the subsoil. Sleeth and Westland soils have a solum that is thicker than that of the Eldean soils and have a gray subsoil. They are in the lower positions on the landscape.

Typical pedon of Eldean loam, 2 to 6 percent slopes, eroded, in a cultivated field; 2,460 feet north and 900 feet west of the southeast corner of sec. 19, T. 15 N., R. 9 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine and very fine roots; about 13 percent gravel; neutral; abrupt smooth boundary.

Bt1—8 to 19 inches; brown (10YR 4/3) gravelly clay loam; moderate fine subangular blocky structure; firm; common fine and very fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 20 percent gravel; medium acid; clear wavy boundary.

Bt2—19 to 28 inches; brown (10YR 4/3) very gravelly sandy clay; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds; about 37 percent gravel; medium acid; clear wavy boundary.

Bt3—28 to 33 inches; dark brown (10YR 3/3) sandy clay loam; weak coarse subangular blocky structure; friable; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 3 percent gravel; neutral; abrupt irregular boundary.

2C—33 to 60 inches; yellowish brown (10YR 5/4) stratified coarse sand and gravelly coarse sand; single grain; loose; about 10 percent cobbles; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The content of gravel is as much as 30 percent in the upper part of the solum and as much as 40 percent in the lower part. Some pedons have a silty mantle that is as much as 18 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is loam, silt loam, or clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. It is commonly clay loam, sandy clay loam, gravelly sandy clay loam, gravelly sandy clay, or gravelly clay loam, but in some pedons it is silty clay loam in the upper part. It is slightly acid to strongly acid in the upper part and is neutral to moderately alkaline in the lower part.

Fincastle Series

The Fincastle series consists of deep, somewhat poorly drained soils on uplands. Permeability is moderate in the subsoil and moderately slow in the substratum. These soils formed in loess and in the underlying glacial till. Slopes range from 0 to 2 percent.

Fincastle soils are similar to Crosby soils and are adjacent to Cyclone, Miami, Russell, Williamstown, and Xenia soils. Crosby soils have more clay in the subsoil than the Fincastle soils. Cyclone soils have a surface layer that is thicker and darker than that of the Fincastle soils and are gray throughout the subsoil. They are in depressions. Miami, Russell, Williamstown, and Xenia soils do not have mottles in the upper part of the subsoil. They are in the slightly higher areas.

Typical pedon of Fincastle silt loam, 0 to 2 percent slopes, in a cultivated field; 317 feet south and 2,360 feet east of the northwest corner of sec. 23, T. 12 N., R. 10 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and very fine roots; strongly acid; abrupt smooth boundary.

E—10 to 13 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common fine and very fine roots; strongly acid; clear smooth boundary.

Bt1—13 to 21 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine and common very fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—21 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and few medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few very dark brown (7.5YR 2/2) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

2Bt3—27 to 34 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few very dark brown (7.5YR 2/2) iron and manganese oxide accumulations; about 5 percent gravel; neutral; clear wavy boundary.

2Bt4—34 to 50 inches; brown (10YR 5/3) clay loam; common medium distinct light brownish gray (10YR 6/2) and few medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few very dark brown (7.5YR 2/2) iron and manganese oxide accumulations; about 5 percent gravel; mildly alkaline; abrupt wavy boundary.

2C—50 to 60 inches; brown (10YR 5/3) loam; many medium distinct light brownish gray (10YR 6/2) and few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few very dark brown (7.5YR 2/2) iron and manganese oxide accumulations; about 10 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The loess cap is 20 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is strongly acid or medium acid. The 2Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is slightly acid to mildly alkaline. The 2Bt4 horizon is clay loam or loam.

Genesee Series

The Genesee series consists of deep, well drained soils on bottom land. These soils are moderately permeable. They formed in alluvium. Slopes range from 0 to 2 percent.

Genesee soils are adjacent to Shoals and Sloan soils. The adjacent soils are mottled in the upper part of the subsoil. They are in the slightly lower areas or in areas

near small drainageways that are outlets to the wider stream bottoms.

Typical pedon of Genesee loam, gravelly substratum, in a cultivated field; 230 feet north and 450 feet west of the southeast corner of sec. 3, T. 15 N., R. 8 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine and very fine roots; mildly alkaline; abrupt smooth boundary.

Bw1—8 to 17 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common fine and very fine roots; thin continuous dark brown (10YR 3/3) organic coatings on faces of peds; mildly alkaline; clear smooth boundary.

Bw2—17 to 25 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; common very fine roots; thin continuous dark brown (10YR 3/3) organic coatings on faces of peds; neutral; clear smooth boundary.

BC—25 to 34 inches; brown (10YR 4/3) loam; weak coarse subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) organic coatings on faces of peds; mildly alkaline; gradual smooth boundary.

C1—34 to 46 inches; yellowish brown (10YR 5/4) loam; moderate medium distinct grayish brown (10YR 5/2) mottles; massive; slight effervescence; moderately alkaline; gradual smooth boundary.

C2—46 to 55 inches; dark grayish brown (10YR 4/2) loam; moderate medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

2C3—55 to 60 inches; brown (10YR 5/3) stratified very gravelly coarse sand and coarse sand; single grain; loose; about 50 percent gravel; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is silt loam or loam. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The lower part of the B horizon may have chroma of 2. The Bw horizon is silt loam or loam. It is neutral or mildly alkaline in the upper part and neutral to moderately alkaline in the lower part. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam, loam, or sandy loam, and it may be stratified. Below a depth of 50 inches, it is stratified loam, gravelly coarse sand, coarse sand, sand, gravelly loamy sand, or loamy sand. It is mildly alkaline or moderately alkaline.

Miami Series

The Miami series consists of deep, well drained soils on uplands. Permeability is moderate in the subsoil. It generally is moderately slow in the substratum. In some pedons, however, the substratum is rapidly permeable because it is gravelly. These soils formed in loess and in the underlying glacial till. Slopes range from 2 to 35 percent.

Miami soils are similar to Miamian and Russell soils and are adjacent to Fincastle, Williamstown, and Xenia soils. Miamian soils have more clay in the subsoil than the Miami soils, and Fincastle, Russell, and Xenia soils have less sand in the subsoil. Fincastle, Williamstown, and Xenia soils have a mottled subsoil. They are in the lower areas.

Typical pedon of Miami silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 2,200 feet south and 2,600 feet west of the northeast corner of sec. 1, T. 12 N., R. 10 E.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and very fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 13 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common fine and very fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt2—13 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

2Bt3—20 to 29 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few very fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

2Bt4—29 to 36 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; firm; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; slight effervescence; moderately alkaline; gradual wavy boundary.

2C—36 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct pale brown (10YR 6/3) mottles; massive; firm; about 11 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The loess cap ranges from 0 to 18 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is silt loam, loam, or clay loam. In wooded areas the A1 horizon commonly is very dark grayish brown (10YR 3/2). The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is strongly acid to neutral.

Miamian Series

The Miamian series consists of deep, well drained soils on uplands. These soils are moderately slowly permeable. They formed in loess and in the underlying glacial till. Slopes range from 2 to 35 percent.

Miamian soils are similar to Miami and Russell soils and are adjacent to Celina, Crosby, Patton, and Treaty soils. Miami soils have more sand and less clay in the subsoil than the Miamian soils. Russell soils also have less clay in the subsoil. Celina and Crosby soils have a mottled subsoil. They are in the lower positions on the landscape. Patton and Treaty soils have a mollic epipedon, have less clay in the subsoil than the Miamian soils, and are gray throughout the subsoil. They are in depressions.

Typical pedon of Miamian silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 2,430 feet north and 125 feet east of the southwest corner of sec. 4, T. 15 N., R. 11 E.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine and very fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

Bt1—9 to 19 inches; dark yellowish brown (10YR 4/4) clay; moderate medium subangular blocky structure; firm; common fine and very fine roots; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

Bt2—19 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few fine and very fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

Bt3—26 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure; firm; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; about 9 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; about 10 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. It is very strongly acid to neutral in the upper part and slightly acid to mildly alkaline in the lower part. The loess cap is 0 to 18 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam, loam, or clay loam. In wooded areas the A horizon is 1 to 4 inches thick. It is very dark grayish brown (10YR 3/2). The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. In some pedons it is silty clay loam.

Millsdale Series

The Millsdale series consists of moderately deep, very poorly drained soils in depressions on stream terraces. These soils are moderately slowly permeable. They formed in glacial drift underlain by limestone. Slopes range from 0 to 2 percent.

Millsdale soils are commonly adjacent to Milton soils. The adjacent soils do not have a mollic epipedon, have a brown subsoil, and are in the higher positions on the landscape.

Typical pedon of Millsdale silty clay loam, in a cultivated field; 150 feet north and 200 feet east of the southwest corner of sec. 8, T. 12 N., R. 9 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many medium fine and very fine roots; about 3 percent gravel; mildly alkaline; abrupt smooth boundary.

Btg1—10 to 16 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine subangular blocky structure; firm; many fine and very fine roots; thin continuous black (N 2/0) clay films on faces of peds; about 1 percent gravel; mildly alkaline; clear wavy boundary.

Btg2—16 to 24 inches; dark grayish brown (10YR 4/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 3 percent gravel; mildly alkaline; abrupt smooth boundary.

2C—24 to 28 inches; very pale brown (10YR 7/3) extremely channery silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; about 64 percent weathered limestone fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

2R—28 inches; limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The thickness of the solum may be less than the depth to bedrock. The solum generally is neutral or mildly alkaline. In some pedons, however, it is moderately alkaline in the lower part.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or clay loam. The Btg horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. It is clay loam, silty clay loam, or silty clay. The 2C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3. The content of weathered limestone fragments in this horizon is 2 to 75 percent. Some pedons do not have a 2C horizon.

Milton Series

The Milton series consists of moderately deep, well drained soils on stream terraces. These soils are moderately slowly permeable. They formed in glacial drift and in the underlying material weathered from limestone. Slopes range from 0 to 3 percent.

Milton soils are adjacent to Millsdale soils. The adjacent soils have a mollic epipedon, are gray throughout the subsoil, and are in the lower positions on the landscape.

Typical pedon of Milton silt loam, 0 to 3 percent slopes, in a cultivated field; 2,425 feet north and 400 feet west of the southeast corner of sec. 19, T. 12 N., R. 9 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; about 3 percent gravel; mildly alkaline; abrupt smooth boundary.

A—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine subangular blocky structure; friable; many fine roots; about 3 percent gravel; mildly alkaline; clear smooth boundary.

Bt1—13 to 19 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; many fine roots; about 3 percent gravel; neutral; gradual wavy boundary.

2Bt2—19 to 28 inches; dark yellowish brown (10YR 4/4) clay; moderate fine subangular blocky structure; firm; common roots; thin continuous clay films on faces of peds; about 5 percent gravel, including weathered limestone fragments near the lithic contact; mildly alkaline; abrupt wavy boundary.

2R—28 inches; limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. In some pedons the thickness of the solum is less than the depth to bedrock. In some areas the depth to bedrock is uniform, but in other areas it varies within short distances. The solum is neutral or mildly alkaline.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay or clay loam. Some pedons have a 2C horizon between the solum and the bedrock. This horizon is silt loam or clay loam weathered from limestone.

Ockley Series

The Ockley series consists of deep, well drained soils on terraces and outwash plains. Permeability is moderate in the subsoil and very rapid in the substratum. These soils formed in loess and in the underlying glacial outwash. Slopes range from 0 to 6 percent.

Ockley soils are similar to Eldean soils and are adjacent to Sleeth and Westland soils. Eldean soils have more clay in the subsoil than the Ockley soils and are shallower to calcareous sand and gravel. Sleeth and Westland soils have a mottled subsoil. They are in the lower positions on the landscape.

Typical pedon of Ockley silt loam, 0 to 2 percent slopes, in a cultivated field; 195 feet north and 1,850 feet east of the southwest corner of sec. 18, T. 15 N., R. 11 E.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine and very fine roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.

BA—10 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common fine and very fine roots; about 2 percent gravel; slightly acid; clear wavy boundary.

Bt1—15 to 18 inches; dark brown (7.5YR 4/4) silt loam; moderate fine subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; common fine and very fine roots; about 5 percent gravel; slightly acid; clear wavy boundary.

2Bt2—18 to 30 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine and very fine roots; about 6 percent gravel; medium acid; clear wavy boundary.

2Bt3—30 to 37 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; thin discontinuous dark reddish brown (5YR 3/3) clay films on faces of peds; about 10 percent gravel; strongly acid; clear wavy boundary.

2Bt4—37 to 49 inches; dark reddish brown (5YR 3/3) gravelly sandy clay loam; weak medium subangular blocky structure; friable; common clay bridging between sand grains; about 26 percent gravel; neutral; abrupt wavy boundary.

3C—49 to 60 inches; yellowish brown (10YR 5/4) stratified coarse sand and very gravelly coarse sand; single grain; loose; about 49 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The loess cap is 0 to 20 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is silt loam or loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The upper part of the 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is medium acid or strongly acid. The lower part has hue of 5YR or 7.5YR, value of 3

or 4, and chroma of 2 or 3. It is neutral to medium acid. The 2Bt horizon is clay loam or sandy clay loam or the gravelly analogs of these textures. The content of gravel in this horizon is 5 to 35 percent.

Patton Series

The Patton series consists of deep, poorly drained soils in depressions on lake plains. These soils are moderately slowly permeable. They formed in lacustrine material derived from Wisconsin drift. Slopes range from 0 to 2 percent.

Patton soils are similar to Treaty soils and are adjacent to Crosby and Miamian soils. Treaty soils have an argillic horizon. Crosby and Miamian soils are not gray throughout the subsoil and have a surface layer that is lighter colored than that of the Patton soils. They are in the higher positions on the landscape.

Typical pedon of Patton silty clay loam, in a cultivated field; 415 feet south and 1,330 feet west of the northeast corner of sec. 14, T. 15 N., R. 9 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine granular structure; firm; few fine and very fine roots; medium acid; abrupt smooth boundary.

Bg1—10 to 15 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; firm; few fine and very fine roots; slightly acid; clear wavy boundary.

Bg2—15 to 25 inches; dark gray (10YR 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; neutral; clear wavy boundary.

BCg—25 to 37 inches; gray (10YR 5/1) silt loam; many medium distinct dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; firm; slight effervescence; neutral; clear wavy boundary.

Cg1—37 to 56 inches; gray (10YR 6/1) silt loam; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; firm; slight effervescence; mildly alkaline; clear wavy boundary.

Cg2—56 to 60 inches; yellowish brown (10YR 5/4) silt loam that has thin strata of sand; common medium faint yellowish brown (10YR 5/6) and few fine distinct gray (10YR 6/1) mottles; massive; strong effervescence; moderately alkaline.

The solum is 26 to 42 inches thick. It is slightly acid to mildly alkaline. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or silt loam. The Bg horizon also is silty clay loam or silt loam. It has hue of 10YR, value of 4 to 6, and chroma of 1 or 2.

Russell Series

The Russell series consists of deep, well drained soils on uplands. These soils are moderately permeable. They formed in loess and in the underlying glacial till. Slopes range from 2 to 6 percent.

Russell soils are similar to Miami and Miamian soils and are adjacent to Fincastle and Xenia soils. Miami soils have more sand in the subsoil than the Russell soils. Miamian soils have more clay in the subsoil than the Russell soils. Fincastle and Xenia soils are in the slightly lower positions on the landscape. Fincastle soils are mottled in the upper part of the subsoil. Xenia soils are mottled in the lower part of the subsoil.

Typical pedon of Russell silt loam, 2 to 6 percent slopes, in a cultivated field; 800 feet south and 170 feet west of the northeast corner of sec. 14, T. 12 N., R. 10 E.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine and very fine roots; medium acid; abrupt smooth boundary.

BA—8 to 13 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; common fine and very fine roots; strongly acid; clear smooth boundary.

Bt1—13 to 27 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; medium acid; clear wavy boundary.

2Bt2—27 to 40 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thin continuous brown (10YR 4/3) clay films on faces of peds; few very dark gray (N 3/0) iron and manganese accumulations; about 10 percent gravel; medium acid; clear wavy boundary.

2Bt3—40 to 47 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 6 percent gravel; neutral; abrupt wavy boundary.

2C—47 to 60 inches; brown (10YR 5/3) loam; massive; friable; about 13 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 56 inches thick. The loess cap is 20 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6. It is silt loam or silty clay loam. It is medium acid or strongly acid. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is slightly acid or medium acid. The content of gravel in this horizon is 5 to 10 percent.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained soils on bottom land. These soils are moderately permeable. They formed in alluvium. Slopes range from 0 to 2 percent.

Shoals soils are adjacent to Genesee, Sloan, and Stonelick soils. Genesee soils have a brown subsoil. They are in the slightly higher areas on the wider stream bottoms. Sloan soils are gray throughout the subsoil and are in depressions. Stonelick soils have a subsoil that is brown and that contains less clay than that of the Shoals soils. They are in the slightly higher positions on the landscape.

Typical pedon of Shoals silt loam, frequently flooded, in a cultivated field; 334 feet north and 388 feet east of the southwest corner of sec. 11, T. 12 N., R. 11 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many medium, fine, and very fine roots; neutral; abrupt smooth boundary.

BA—9 to 15 inches; dark grayish brown (10YR 4/2) silt loam; common medium faint brown (10YR 4/3) mottles; moderate fine subangular blocky structure; friable; common fine and very fine roots; neutral; clear smooth boundary.

Bw1—15 to 21 inches; brown (10YR 4/3) silt loam; many medium faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; few fine and very fine roots; neutral; clear smooth boundary.

Bw2—21 to 27 inches; dark grayish brown (10YR 4/2) loam; many medium distinct brown (10YR 4/3) mottles; weak medium prismatic structure; friable; neutral; clear smooth boundary.

BC—27 to 39 inches; yellowish brown (10YR 5/4) loam; many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

C—39 to 50 inches; yellowish brown (10YR 5/4) loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; neutral; abrupt smooth boundary.

Cg1—50 to 57 inches; light brownish gray (10YR 6/2) stratified loamy sand and sandy loam; common medium faint pale brown (10YR 6/3) mottles; massive; very friable; mildly alkaline; abrupt smooth boundary.

Cg2—57 to 60 inches; light brownish gray (10YR 6/2) stratified sand and gravelly sand; common medium faint pale brown (10YR 6/3) mottles; loose; strong effervescence; moderately alkaline.

The control section ranges from slightly acid to mildly alkaline. Free carbonates are at a depth of 30 to 60 inches.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly silt loam or loam, but in some pedons individual subhorizons are sandy loam. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4.

Sleeth Series

The Sleeth series consists of deep, somewhat poorly drained soils on terraces and outwash plains. Permeability is moderate in the subsoil and very rapid in the substratum. These soils formed in loess and in the underlying glacial outwash. Slopes range from 0 to 2 percent.

These soils have a thicker silty mantle than is definitive for the Sleeth series. This difference, however, does not alter the usefulness or behavior of the soils.

Sleeth soils are adjacent to Eldean, Ockley, and Westland soils. Eldean and Ockley soils have a brown subsoil. They are in the higher positions on the landscape. Westland soils have a surface layer that is thicker and darker than that of the Sleeth soils and are gray throughout the subsoil. They are in the lower areas and depressions.

Typical pedon of Sleeth silt loam, in a cultivated field; 1,400 feet north and 1,600 feet east of the southwest corner of sec. 5, T. 15 N., R. 9 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine and very fine roots; about 4 percent gravel; slightly acid; abrupt smooth boundary.

Bt—8 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common fine and very fine roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; about 4 percent gravel; slightly acid; clear wavy boundary.

Btg1—14 to 21 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 5 percent gravel; medium acid; clear wavy boundary.

Btg2—21 to 28 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse and medium subangular blocky structure; firm; few very fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.

2Btg3—28 to 39 inches; grayish brown (10YR 5/2) sandy clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium

subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; about 13 percent gravel; few strong brown (7.5YR 4/6) iron oxide accumulations; neutral; clear wavy boundary.

2BC—39 to 44 inches; grayish brown (10YR 5/2) gravelly sandy clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; about 15 percent gravel; moderately alkaline; clear wavy boundary.

3C—44 to 60 inches; yellowish brown (10YR 5/4) stratified coarse sand and gravelly coarse sand; single grain; loose; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The loess cap ranges from 0 to 20 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 to 3. It is silt loam or loam. The Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam, silt loam, or clay loam. It is neutral to strongly acid, becoming less acid as depth increases. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4. It is sandy clay loam or clay loam or the gravelly analogs of these textures.

Sloan Series

The Sloan series consists of deep, very poorly drained soils in depressional areas on bottom land. These soils are moderately slowly permeable. They formed in alluvium. Slopes range from 0 to 2 percent.

Sloan soils are adjacent to Genesee, Shoals, and Stonelick soils in the higher positions on the landscape. The adjacent soils have a subsoil that is browner than that of the Sloan soils. Also, Stonelick soils have less clay in the subsoil.

Typical pedon of Sloan silt loam, frequently flooded, in a cultivated field; 452 feet south and 1,980 feet west of the northeast corner of sec. 28, T. 12 N., R. 9 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine and very fine roots; neutral; abrupt smooth boundary.

A—9 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common fine and very fine roots; neutral; clear smooth boundary.

Bg1—13 to 29 inches; dark gray (10YR 4/1) loam; few medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine and very fine roots; mildly alkaline; clear wavy boundary.

1Bg2—29 to 38 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few very fine roots; mildly alkaline; clear wavy boundary.

BCg—38 to 45 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; neutral; clear wavy boundary.

C—45 to 56 inches; yellowish brown (10YR 5/4) loam; common medium distinct gray (10YR 5/1) mottles; massive; friable; slight effervescence; mildly alkaline; clear wavy boundary.

Cg—56 to 60 inches; gray (10YR 5/1) stratified loam and sandy loam; massive; friable; strong effervescence; mildly alkaline.

The solum is 25 to 50 inches thick. The mollic epipedon is 10 to 24 inches thick.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silt loam or silty clay loam. The Bg horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam, clay loam, loam, or silt loam. It is neutral or mildly alkaline and may contain free carbonates in the lower part. The C horizon is stratified silt loam, loam, or sandy loam.

Stonelick Series

The Stonelick series consists of deep, well drained soils on bottom land. These soils are moderately rapidly permeable. They formed in alluvium. Slopes range from 0 to 2 percent.

These soils have a slightly thicker and darker surface layer than is definitive for the Stonelick series and have more gravel and cobbles in the substratum. These differences, however, do not alter the usefulness or behavior of the soils.

Stonelick soils are adjacent to Shoals and Sloan soils. The adjacent soils have less sand in the subsoil than the Stonelick soils. Also, Shoals soils are farther away from the larger streams or are in areas near small drainageways that are outlets to the wider stream bottoms. Sloan soils are gray throughout the subsoil. They are in depressions.

Typical pedon of Stonelick sandy loam, frequently flooded, in a cultivated field; 2,270 feet north and 1,400 feet east of the southwest corner of sec. 29, T. 12 N., R. 9 E.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many medium, fine, and very fine roots; about 2 percent gravel; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—12 to 18 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; friable; many medium, fine, and very fine roots; about 4 percent gravel; strong effervescence; mildly alkaline; clear wavy boundary.

C2—18 to 26 inches; yellowish brown (10YR 5/4) gravelly sandy loam; massive; very friable; many medium, fine, and very fine roots; about 20 percent gravel; violent effervescence; moderately alkaline; clear wavy boundary.

C3—26 to 60 inches; brown (10YR 5/3) gravelly coarse sandy loam; massive; very friable; few medium, fine, and very fine roots; about 29 percent gravel; about 16 percent flagstones; violent effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. It is sandy loam or loam. The content of gravel in this horizon ranges from 2 to 15 percent. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam, loamy sand, gravelly loamy sand, gravelly coarse sandy loam, or gravelly sandy loam. The content of gravel and flagstones in this horizon ranges from 2 to 50 percent.

Treaty Series

The Treaty series consists of deep, very poorly drained soils in depressional areas and along narrow drainageways on uplands. Permeability is moderate in the subsoil and moderately slow in the substratum. These soils formed in loess and in the underlying glacial till. Slopes range from 0 to 2 percent.

Treaty soils are similar to Cyclone and Patton soils and are adjacent to Crosby and Miamian soils. Cyclone soils have a loess cap that is thicker than that of the Treaty soils and contain less sand in the lower part of the subsoil. Patton soils do not have an argillic horizon. Crosby and Miamian soils have a surface layer that is lighter colored than that of the Treaty soils and have a browner subsoil. They are in the higher positions on the landscape.

Typical pedon of Treaty silty clay loam, in a cultivated field; 105 feet south and 905 feet west of the northeast corner of sec. 11, T. 15 N., R. 9 E.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak medium granular structure; friable; many fine and very fine roots; neutral; abrupt smooth boundary.

Btg1—11 to 18 inches; gray (10YR 5/1) silty clay loam, gray (10YR 6/1) dry; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine and very fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; neutral; clear wavy boundary.

Btg2—18 to 28 inches; gray (10YR 5/1) silty clay loam; common medium distinct olive brown (2.5Y 4/4) mottles; moderate medium subangular blocky structure; firm; few very fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; neutral; clear wavy boundary.

Btg3—28 to 36 inches; gray (10YR 5/1) silty clay loam; many medium distinct olive brown (2.5Y 4/4) mottles; moderate coarse subangular blocky structure; firm; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

2Btg4—36 to 43 inches; gray (10YR 6/1) clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; about 2 percent gravel; mildly alkaline; clear wavy boundary.

2BC—43 to 48 inches; yellowish brown (10YR 5/6) loam; many medium distinct gray (10YR 6/1) mottles; weak coarse subangular blocky structure; friable; about 2 percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

2C—48 to 60 inches; brown (10YR 5/3) loam; common fine distinct gray (10YR 5/1) mottles; massive; friable; about 10 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 45 to 65 inches in thickness. The silty cap is 24 to 40 inches thick. The mollic epipedon is 10 to 18 inches thick.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or silt loam. It is neutral or slightly acid. The Bt horizon also is neutral or slightly acid. It has hue of 10YR, value of 3 to 5, and chroma of 1. The 2Bt has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is neutral or mildly alkaline.

Westland Series

The Westland series consists of deep, very poorly drained soils in depressions on terraces and outwash plains. Permeability is moderate in the subsoil and very rapid in the substratum. These soils formed in glacial outwash. Slopes range from 0 to 2 percent.

Westland soils are adjacent to Eldean, Ockley, and Sleeth soils. The adjacent soils have a surface layer that is lighter colored than that of the Westland soils and have a browner subsoil. They are in the higher positions on the landscape.

Typical pedon of Westland clay loam, in a cultivated field; 204 feet south and 1,097 feet east of the northwest corner of sec. 18, T. 15 N., R. 11 E.

Ap—0 to 11 inches; dark brown (7.5YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak medium granular structure; friable; many fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

Bg—11 to 14 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; common fine and

very fine roots; about 2 percent gravel; neutral; clear wavy boundary.

Btg1—14 to 23 inches; grayish brown (2.5Y 5/2) clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous gray (10YR 5/1) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Btg2—23 to 40 inches; grayish brown (2.5Y 5/2) clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous gray (10YR 5/1) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2BCg—40 to 54 inches; light gray (10YR 6/1) gravelly loam; common medium distinct light olive brown (2.5Y 5/6) mottles; weak coarse subangular blocky structure; friable; thin discontinuous gray (10YR 6/1) clay films on the surface of pebbles; about 22 percent gravel; mildly alkaline; clear wavy boundary.

3Cg—54 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand and coarse sand; single grain; loose; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The loess cap ranges from 0 to 20 inches in thickness.

The Ap horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 1 or 2. It is silt loam, silty clay loam, loam, or clay loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or less. It is slightly acid or neutral. The 2BC horizon is gravelly loam or gravelly clay loam. It is neutral or mildly alkaline. In some pedons it contains free carbonates.

Williamstown Series

The Williamstown series consists of deep, moderately well drained soils on uplands. Permeability is moderate in the subsoil and moderately slow in the substratum. These soils formed in loess and in the underlying glacial till. Slopes range from 2 to 6 percent.

Williamstown soils are similar to Celina and Xenia soils and are adjacent to Cyclone, Fincastle, and Miami soils. Celina soils have less sand and more clay in the subsoil than the Williamstown soils. Xenia soils also have less sand in the subsoil. Cyclone soils have a surface layer that is thicker and darker than that of the Williamstown soils and are gray throughout the subsoil. They are in depressions. Fincastle soils have a subsoil that is mottled and that has less sand than that of the Williamstown soils. They are in the slightly lower positions on the landscape. Miami soils have a brown subsoil. They are in the higher, more sloping areas or on side slopes along drainageways.

Typical pedon of Williamstown silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 600 feet north and 2,560 feet west of the southeast corner of sec. 12, T. 12 N., R. 10 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common fine and very fine roots; about 20 percent dark yellowish brown (10YR 4/4) subsoil material; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; firm; common fine and very fine roots; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—14 to 18 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine and very fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—18 to 30 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; few fine and very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The loess cap ranges from 4 to 19 inches in thickness. The depth to free carbonates is 25 to 40 inches. The Bt horizon is strongly acid to neutral in the upper part and neutral or mildly alkaline in the lower part.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have an E horizon. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. In some pedons it is silty clay loam. Some pedons have a BC horizon, which is clay loam or loam.

Xenia Series

The Xenia series consists of deep, moderately well drained soils on uplands. These soils are moderately slowly permeable. They formed in loess and in the underlying glacial till. Slopes range from 1 to 4 percent.

Xenia soils are similar to Williamstown soils and are adjacent to Cyclone, Fincastle, Miami, and Russell soils. Williamstown soils have more sand in the subsoil than the Xenia soils. Cyclone soils have a surface layer that is thicker and darker than that of the Xenia soils and are gray throughout the subsoil. They are in depressions. Fincastle soils are mottled in the upper part of the subsoil. They are in the lower positions on the

landscape. Miami and Russell soils have a brown subsoil. They are in the higher, more sloping areas or on side slopes along drainageways.

Typical pedon of Xenia silt loam, 1 to 4 percent slopes, in a cultivated field; 138 feet north and 105 feet east of the southwest corner of sec. 18, T. 12 N., R. 10 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common medium, fine, and very fine roots; neutral; abrupt smooth boundary.

Bt1—10 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine and very fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; few black (N 2/0) accumulations of iron and manganese oxide; neutral; clear wavy boundary.

Bt2—16 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common fine and very fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; few black (N 2/0) accumulations of iron and manganese oxide; neutral; clear wavy boundary.

2Bt3—26 to 34 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; common black (N 2/0) accumulations of iron and manganese oxide; slightly acid; clear wavy boundary.

2Bt4—34 to 50 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

2C—50 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; strong effervescence; moderately alkaline.

The solum is 40 to 56 inches thick. The loess cap ranges from 22 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt and 2Bt horizons have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. They are neutral to medium acid. The 2BC horizon is neutral or mildly alkaline.

Formation of the Soils

In this section the effects of the major factors of soil formation on the soils in Rush County are described. The processes of soil formation also are described.

Factors of Soil Formation

Soil forms through processes acting on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil formed; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Rush County were deposited by glaciers or by melt water from the glaciers. Some of these materials were reworked and redeposited by subsequent actions of water and wind. The glaciers covered the county from about 10,000 to 20,000 years ago. Although the parent materials are commonly of glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Rush County were deposited as glacial till, outwash, loess, and alluvium.

Glacial till is material laid down directly by a glacier with a minimum of water action. It consists of particles of different sizes that are mixed together. Many of the small pebbles in glacial till have sharp edges and corners, indicating that they have not been worn by washing water. The glacial till in Rush County is calcareous, friable and firm loam. An example of soils that formed in glacial till are those of the Miami series. These soils typically are medium textured and have a well expressed structure.

Outwash was deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the speed of the stream that carried them. When the water slowed down, the coarser particles were deposited. Finer particles, such as very fine sand, silt, and clay, were carried by the more slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as sand and gravel. Ockley soils are an example of soils that formed partly in deposits of outwash material in Rush County.

Loess is soil material that was deposited by wind. After the glaciers melted and moved out of the area, winds deposited a thin layer of loess over the material deposited by the glaciers and the melt water of the glaciers. Since the wind picked up mostly silt-size particles, the loess deposits are very high in content of silt and have very little sand or clay. In Rush County the soil layers that formed in loess are silt loam or silty clay loam. Russell and Fincastle soils are examples of soils in which the upper part of the solum formed in loess.

Alluvium was deposited by floodwater of present streams in recent time. This material varies in texture, depending on the speed of the water from which it was deposited. Alluvium deposited along a swift stream, such as the part of the Flatrock River in southern Rush County, is coarser textured than that deposited along a slow, sluggish stream, such as the part of the Flatrock River in central and northern Rush County. Genesee and Sloan soils are examples of soils that formed in alluvium.

Plant and Animal Life

Plants have been the principal organism influencing the soils in Rush County; however, bacteria, fungi, and earthworms have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds

of native plants that grew on the soil. The remains of these plants accumulated in the surface layer, decayed, and eventually became humus. The roots of the plants provided channels for the downward movement of water and air through the soil, and they added organic matter as they decayed. Bacteria in the soil help to break down the organic matter into plant nutrients.

The native vegetation in Rush County was mainly deciduous trees. Differences in natural soil drainage and minor variations in the parent material affected the composition of the forest species. The well drained upland soils, such as Miami and Russell soils, were covered mainly with oak, yellow-poplar, and hickory. Poorly drained soils supported primarily pin oak, swamp white oak, soft maple, and some marsh grasses and sedges. Cyclone and Westland soils formed under wet conditions and contain a considerable amount of organic matter. The soils in Rush County that formed dominantly under forest vegetation generally have a lower content of organic matter than the soils that formed under a mixture of trees and grasses.

Climate

Climate has important effects on the formation of soils. It determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and the transportation of soil material. Through its effect on soil temperature, it determines the rate of chemical reactions in the soil. These effects tend to be uniform in relatively small areas, such as those the size of a county.

The climate in Rush County is cool and humid. It is presumably similar to the one that prevailed when the soils formed. The soils in the county differ from those that formed under a dry, warm climate and from those that formed under a hot, moist climate. Although the climate is uniform throughout the county, its effects are modified locally by runoff. Therefore, the differences among the soils in the county are, to a minor extent, the result of climatic differences. More detailed information about the climate is available under the heading "General Nature of the County."

Relief

Relief has markedly affected the soils in Rush County through its effect on natural drainage, erosion, plant cover, and soil temperature. The soils have a slope of 0 to 35 percent. They range from well drained in the more sloping areas to very poorly drained in the nearly level depressions. Through its effect on aeration in the soil, natural drainage determines the color of the soil. Runoff is most rapid on the steeper slopes. In low areas it is temporarily ponded. Water and air move freely through well drained soils and slowly through very poorly drained soils. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized, and poorly aerated soils are dull gray and mottled. Miami soils are an example of well drained, well aerated soils, and Westland soils are an example of poorly aerated, very poorly drained soils.

Cyclone and other poorly drained soils, Fincastle and other somewhat poorly drained soils, and Xenia and other moderately well drained soils have characteristics intermediate between those of very poorly drained soils and those of well drained soils.

Time

Time, usually a long time, is needed for the agents of soil formation to form distinct soil horizons. Differences in the length of time that the parent materials have been in place are commonly reflected in the degree of profile development. Some soils form rapidly; others form slowly.

The soils in Rush County range from immature to mature. The glacial deposits in which many of the soils formed have been exposed to soil-forming factors long enough for the development of distinct horizons. Genesee and other soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct horizons.

Genesee and Russell soils show the effects of time on the leaching of lime. The solum of both soils originally contained about the same amount of lime, but now the subsoil of Genesee soils contains more lime than that of Russell soils, which are older and have undergone leaching for a longer period.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Rush County. These processes are the accumulation of organic matter; the dissolution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils more than one of these processes have helped to differentiate soil horizons.

Some organic matter has accumulated in the surface layer of all the soils in the county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Cyclone and Westland soils, have a thick, dark surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching probably preceded the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of the well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by a neutral or acid reaction. Leaching of wet soils is slow because of a seasonal high water table or the slow downward movement of water through the profile.

Clay accumulates in pores and other voids and forms films on the surfaces along which water moves. The leaching of bases and the translocation of silicate clays are among the more important processes affecting horizon differentiation in the soils. Miami soils are an example of soils in which translocated silicate clays have accumulated in the Bt horizon in the form of clay films.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils in the county. In the naturally wet soils, this process has had a significant effect on horizon differentiation. A gray color in the subsoil indicates the reduction of iron oxides. This reduction is commonly accompanied by some transfer of iron from the upper horizons to the lower ones or completely out of the profile. Mottles, which are in some horizons, indicate the segregation of iron.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.
Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.
Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.
Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.
Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
Bottom land. The normal flood plain of a stream, subject to flooding.
Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.
Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.
Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.
Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.
Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.
Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.
Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.
Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.
Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.
Coarse textured soil. Sand or loamy sand.
Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.
Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.
Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.
Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainage system, subsurface. A system that removes excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay,

sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction

because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and

granular. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-78 at Shelbyville, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	35.7	17.0	26.4	63	-12	45	2.70	1.48	3.76	6	4.9
February---	40.4	20.5	30.5	67	-6	59	2.47	1.06	3.66	6	2.2
March------	50.5	29.9	40.2	80	7	149	3.50	2.06	4.78	9	3.1
April------	64.2	41.2	52.7	85	21	385	3.91	2.07	5.53	8	.0
May--------	74.1	50.8	62.4	92	30	694	4.60	2.17	6.68	8	.0
June-------	83.0	59.9	71.4	97	43	942	3.68	1.91	5.22	7	.0
July-------	86.4	63.0	74.7	98	47	1,076	4.39	2.60	5.99	7	.0
August-----	84.8	60.6	72.8	96	45	1,017	3.51	1.77	5.01	5	.0
September--	78.9	53.7	66.4	95	35	792	2.90	1.14	4.38	6	.0
October----	67.5	41.8	54.7	86	23	462	2.46	1.04	3.65	5	.0
November---	52.3	31.8	42.1	77	10	129	3.22	1.67	4.58	6	1.0
December---	40.4	22.6	31.5	67	-4	55	3.15	1.28	4.73	6	3.0
Yearly:											
Average--	63.2	41.1	52.2	---	---	---	---	---	---	---	---
Extreme--	---	---	---	98	-13	---	---	---	---	---	---
Total----	---	---	---	---	---	5,805	40.49	35.37	45.34	79	14.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-78 at Shelbyville, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 16	April 26	May 12
2 years in 10 later than--	April 11	April 21	May 7
5 years in 10 later than--	April 2	April 12	April 26
First freezing temperature in fall:			
1 year in 10 earlier than--	October 22	October 11	October 2
2 years in 10 earlier than--	October 26	October 16	October 6
5 years in 10 earlier than--	November 4	October 26	October 13

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-78 at Shelbyville, Indiana]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	194	174	148
8 years in 10	202	181	155
5 years in 10	216	196	169
2 years in 10	230	210	182
1 year in 10	237	217	189

TABLE 4.--SUITABILITIES AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP FOR SPECIFIED USES

Map unit	Extent of area	Corn, soybeans, and small grain	Grasses and legumes for hay and pasture	Woodland	Septic tank absorption fields	Building site development
	Pct					
1. Genesee-Sloan-Shoals-----	5	Suited: flooding.	Suited: flooding.	Well suited	Unsuited: flooding.	Unsuited: flooding.
2. Miami-Xenia-Russell------	12	Well suited--	Well suited----	Well suited	Suited: slope, erosion hazard, permea-bility.	Suited: slope, erosion hazard, low strength, frost action.
3. Fincastle-Cyclone-Xenia--	22	Well suited--	Well suited----	Well suited	Unsuited: wetness, permea-bility.	Unsuited: wetness, low strength, frost action.
4. Crosby-Treaty------------	42	Well suited--	Well suited----	Well suited	Unsuited: wetness, permea-bility.	Unsuited: wetness, low strength, frost action.
5. Miamian------------------	10	Well suited--	Well suited----	Well suited	Suited: slope, erosion hazard, permea-bility.	Suited: slope, erosion hazard, frost action.
6. Ockley-Westland-Sleeth---	9	Well suited--	Well suited----	Well suited	Poorly suited: wetness.	Poorly suited: wetness, frost action, low strength.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
CeB2	Celina silt loam, 2 to 6 percent slopes, eroded	3,844	1.5
CrA	Crosby silt loam, 0 to 3 percent slopes	51,305	19.6
Cy	Cyclone silty clay loam	21,118	8.1
EdB2	Eldean loam, 2 to 6 percent slopes, eroded	1,928	0.7
ElC3	Eldean clay loam, 6 to 12 percent slopes, severely eroded	658	0.3
ElD3	Eldean clay loam, 12 to 18 percent slopes, severely eroded	262	0.1
FnA	Fincastle silt loam, 0 to 2 percent slopes	23,965	9.2
Ge	Genesee loam, gravelly substratum	5,158	2.0
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded	6,564	2.5
MmD	Miami silt loam, 12 to 18 percent slopes	432	0.2
MmE	Miami silt loam, 18 to 35 percent slopes	573	0.2
MoC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	5,256	2.0
MoD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	885	0.3
MrA	Miami silt loam, gravelly substratum, 0 to 2 percent slopes	3,071	1.2
MpB2	Miamian silt loam, 2 to 6 percent slopes, eroded	19,633	7.5
MpC	Miamian silt loam, 6 to 12 percent slopes	481	0.2
MpD	Miamian silt loam, 12 to 18 percent slopes	905	0.3
MpE	Miamian silt loam, 18 to 35 percent slopes	1,103	0.4
MuC3	Miamian clay loam, 6 to 12 percent slopes, severely eroded	5,768	2.2
MuD3	Miamian clay loam, 12 to 18 percent slopes, severely eroded	1,873	0.7
Mx	Millsdale silty clay loam	133	0.1
MzA	Milton silt loam, 0 to 3 percent slopes	615	0.2
OcA	Ockley silt loam, 0 to 2 percent slopes	10,628	4.1
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded	541	0.2
Pn	Patton silty clay loam	1,869	0.7
Px	Pits, quarry	116	*
RuB	Russell silt loam, 2 to 6 percent slopes	7,446	2.8
Sh	Shoals silt loam, frequently flooded	5,959	2.3
Sm	Sleeth silt loam	4,023	1.5
So	Sloan silt loam, frequently flooded	6,180	2.4
St	Stonelick sandy loam, frequently flooded	196	0.1
Tr	Treaty silty clay loam	39,393	15.1
Ws	Westland clay loam	10,087	3.9
WwB2	Williamstown silt loam, 2 to 6 percent slopes, eroded	1,873	0.7
XeB	Xenia silt loam, 1 to 4 percent slopes	17,426	6.7
	Total	261,267	100.0

* Less than 0.1 percent.

TABLE 6.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
CeB2	Celina silt loam, 2 to 6 percent slopes, eroded
CrA	Crosby silt loam, 0 to 3 percent slopes (where drained)
Cy	Cyclone silty clay loam (where drained)
EdB2	Eldean loam, 2 to 6 percent slopes, eroded
FnA	Fincastle silt loam, 0 to 2 percent slopes (where drained)
Ge	Genesee loam, gravelly substratum (where protected from flooding or not frequently flooded during the growing season)
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded
MrA	Miami silt loam, gravelly substratum, 0 to 2 percent slopes
MpB2	Miamian silt loam, 2 to 6 percent slopes, eroded
Mx	Millsdale silty clay loam (where drained)
MzA	Milton silt loam, 0 to 3 percent slopes
OcA	Ockley silt loam, 0 to 2 percent slopes
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded
Pn	Patton silty clay loam (where drained)
RuB	Russell silt loam, 2 to 6 percent slopes
Sh	Shoals silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)
Sm	Sleeth silt loam (where drained)
So	Sloan silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)
St	Stonelick sandy loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Tr	Treaty silty clay loam (where drained)
Ws	Westland clay loam (where drained)
WwB2	Williamstown silt loam, 2 to 6 percent slopes, eroded
XeB	Xenia silt loam, 1 to 4 percent slopes

TABLE 7.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
CeB2 Celina	IIe	105	40	45	4.5	9.0
CrA Crosby	IIw	105	37	47	3.4	6.8
Cy Cyclone	IIw	155	54	55	5.1	10.2
EdB2 Eldean	IIe	100	35	40	4.5	9.0
ElC3 Eldean	IVe	75	20	30	3.5	7.0
ElD3 Eldean	VIe	---	---	---	3.0	6.0
FnA Fincastle	IIw	130	46	52	4.3	8.6
Ge Genesee	IIw	105	37	41	3.5	8.0
MmB2 Miami	IIe	105	37	47	3.4	6.8
MmD Miami	IVe	85	30	38	2.8	5.6
MmE Miami	VIIe	---	---	---	---	3.2
MoC3 Miami	IVe	90	32	40	3.0	6.0
MoD3 Miami	VIe	---	---	---	2.5	5.0
MrA Miami	I	105	40	45	5.0	9.0
MpB2 Miamian	IIe	110	36	50	4.5	9.0
MpC Miamian	IIIe	100	32	48	4.5	9.0
MpD Miamian	IVe	80	28	44	4.0	8.0
MpE Miamian	VIIe	---	---	---	---	3.2
MuC3 Miamian	IVe	90	26	40	4.0	8.0
MuD3 Miamian	VIe	---	---	---	---	3.0
Mx Millsdale	IIIw	112	44	50	4.8	9.6

See footnotes at end of table.

TABLE 7.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Bromegrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
MzA----------------------- Milton	IIe	90	30	40	4.0	8.0
OcA----------------------- Ockley	I	110	38	44	3.6	7.2
OcB2---------------------- Ockley	IIe	105	37	42	3.4	6.8
Pn------------------------ Patton	IIw	148	48	56	5.6	11.2
Px**. Pits						
RuB----------------------- Russell	IIe	120	42	48	4.0	8.0
Sh------------------------ Shoals	IVw	80	32	33	3.0	8.0
Sm------------------------ Sleeth	IIw	120	42	48	4.0	8.0
So------------------------ Sloan	IIIw	110	35	---	4.0	8.0
St------------------------ Stonelick	IIIw	80	28	---	3.5	7.0
Tr------------------------ Treaty	IIw	150	52	65	4.8	9.6
Ws------------------------ Westland	IIw	140	49	56	4.6	9.2
WwB2---------------------- Williamstown	IIe	110	40	45	4.0	7.8
XeB----------------------- Xenia	IIe	120	42	48	4.0	8.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	13,699	---	---	---
II	216,788	59,870	156,918	---
III	6,990	481	6,509	---
IV	18,978	13,019	5,959	---
V	---	---	---	---
VI	3,020	3,020	---	---
VII	1,676	1,676	---	---
VIII	---	---	---	---

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
CeB2 Celina	1a	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar White oak Black walnut Black cherry Sugar maple White ash	90 110 --- --- --- --- ---	Eastern white pine, black walnut, red pine, yellow-poplar, white ash, northern red oak, white oak.
CrA Crosby	3a	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum Northern red oak	75 85 85 80 75	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
Cy Cyclone	2w	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, red maple, white ash, sweetgum.
EdB2, ElC3 Eldean	2a	Slight	Slight	Slight	Slight	Northern red oak Black oak White oak Black walnut Black cherry Sugar maple White ash Yellow-poplar	80 80 80 --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.
ElD3 Eldean	2r	Moderate	Moderate	Slight	Slight	Northern red oak Black oak White oak Black walnut Black cherry Sugar maple White ash Yellow-poplar	80 80 80 --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.
FnA Fincastle	3a	Slight	Slight	Slight	Slight	Northern red oak White oak Pin oak Yellow-poplar Sweetgum	75 75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
Ge Genesee	1a	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar.
MmB2, MmD Miami	1a	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
MmE Miami	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
MoC3, MoD3 Miami	1a	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
MrA Miami	1a	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Yellow-poplar, white ash, black walnut, red pine, white oak.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
MpB2, MpC: Miamian	1a	Slight	Slight	Slight	Slight	Northern red oak	87	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						Black walnut	---	
						White oak	---	
						Yellow-poplar	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
MpD, MpE: Miamian	1r	Moderate	Moderate	Slight	Slight	Northern red oak	87	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						Black walnut	---	
						White oak	---	
						Yellow-poplar	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
MuC3: Miamian	1a	Slight	Slight	Slight	Slight	Northern red oak	87	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						Black walnut	---	
						White oak	---	
						Yellow-poplar	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
MuD3: Miamian	1r	Moderate	Moderate	Slight	Slight	Northern red oak	87	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						Black walnut	---	
						White oak	---	
						Yellow-poplar	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
Mx: Millsdale	2w	Slight	Severe	Severe	Severe	Pin oak	86	Red maple, American sycamore, eastern cottonwood, pin oak, green ash, swamp white oak, sweetgum.
						Red maple	---	
						Eastern cottonwood	---	
						Black cherry	---	
						Green ash	---	
						Swamp white oak	---	
MzA: Milton	2a	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
						Yellow-poplar	95	
						Black walnut	---	
						Black cherry	---	
						White oak	---	
						White ash	---	
						Sugar maple	---	
OcA, OcB2: Ockley	1a	Slight	Slight	Slight	Slight	White oak	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Northern red oak	90	
						Yellow-poplar	98	
						Sweetgum	76	
Pn: Patton	2w	Slight	Severe	Moderate	Moderate	Pin oak	85	Eastern white pine, red maple, white ash, sweetgum.
						White oak	75	
						Sweetgum	80	
						Northern red oak	75	
RuB: Russell	1a	Slight	Slight	Slight	Slight	White oak	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust, white oak, northern red oak, green ash, black cherry.
						Northern red oak	90	
						Yellow-poplar	98	
						Sweetgum	76	

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Sh: Shoals	2w	Slight	Moderate	Moderate	Slight	Pin oak	90	Sweetgum, red maple, swamp chestnut oak, pin oak, yellow-poplar.
						Sweetgum	86	
						Yellow-poplar	90	
						Virginia pine	90	
						Eastern cottonwood	---	
						White ash	---	
Sm: Sleeth	3a	Slight	Slight	Slight	Slight	Pin oak	85	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
						Yellow-poplar	85	
						Sweetgum	80	
						White oak	70	
So: Sloan	2w	Slight	Severe	Severe	Severe	Pin oak	86	Red maple, green ash, eastern cottonwood, sweetgum, pin oak, swamp white oak, silver maple, American sycamore.
						Swamp white oak	---	
						Red maple	---	
						Green ash	---	
						Eastern cottonwood	---	
St: Stonelick	2a	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.
						White oak	---	
						Black walnut	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
						Yellow-poplar	---	
Tr: Treaty	2w	Slight	Severe	Severe	Severe	Pin oak	90	Eastern white pine, red maple, white ash, sweetgum.
						White oak	75	
						Sweetgum	90	
						Northern red oak	---	
Ws: Westland	2w	Slight	Severe	Severe	Severe	Pin oak	85	Eastern white pine, red maple, white ash, sweetgum.
						Sweetgum	90	
						White oak	75	
WwB2: Williamstown	1a	Slight	Slight	Slight	Slight	White oak	85	Black walnut, white oak, yellow-poplar.
						Yellow-poplar	100	
						White ash	85	
XeB: Xenia	1a	Slight	Slight	Slight	Slight	White oak	90	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar	98	
						Sweetgum	76	

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
CeB2: Celina	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, white fir, blue spruce, Washington hawthorn, Austrian pine.	Norway spruce	Pin oak, eastern white pine.
CrA: Crosby	---	Arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Cy: Cyclone	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
EdB2, ElC3, ElD3: Eldean	Siberian peashrub	Autumn-olive, eastern redcedar, radiant crab-apple, Tatarian honeysuckle, Washington hawthorn, Amur honeysuckle, lilac.	Austrian pine, eastern white pine, jack pine, red pine.	---	---
FnA: Fincastle	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Ge: Genesee	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
MmB2, MmD, MmE, MoC3, MoD3: Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
MrA: Miami	---	Amur privet, silky dogwood, American cranberrybush, Amur honeysuckle.	Northern white-cedar, Washington hawthorn, blue spruce, Austrian pine, white fir.	Norway spruce	Eastern white pine, pin oak.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
MpB2, MpC, MpD, MpE, MuC3, MuD3-- Miamian	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Blue spruce, white fir, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Mx---------------- Millsdale	---	American cranberrybush, silky dogwood, Amur privet, Amur honeysuckle.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	---
MzA--------------- Milton	Siberian peashrub	Amur honeysuckle, lilac, Tatarian honeysuckle, autumn-olive, Washington hawthorn, radiant crabapple, eastern redcedar.	Jack pine, red pine, Austrian pine, eastern white pine.	---	---
OcA, OcB2--------- Ockley	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Pn---------------- Patton	---	Amur privet, silky dogwood, American cranberrybush, Amur honeysuckle.	White fir, northern white-cedar, blue spruce, Austrian pine, Washington hawthorn, Norway spruce.	Eastern white pine	Pin oak.
Px*. Pits					
RuB--------------- Russell	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Sh---------------- Shoals	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Sm---------------- Sleeth	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
So----------------- Sloan	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
St----------------- Stonelick	---	Tatarian honeysuckle, Siberian peashrub.	Green ash, eastern redcedar, osageorange, northern white-cedar, nannyberry viburnum, white spruce, Washington hawthorn.	Black willow------	---
Tr----------------- Treaty	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Ws----------------- Westland	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
WwB2--------------- Williamstown	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
XeB---------------- Xenia	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CeB2: Celina	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Slight.
CrA: Crosby	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Cy: Cyclone	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
EdB2: Eldean	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: droughty.
ElC3: Eldean	Moderate: percs slowly, slope.	Moderate: percs slowly, slope.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
ElD3: Eldean	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
FnA: Fincastle	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ge: Genesee	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
MmB2: Miami	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
MmD: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MmE: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MoC3: Miami	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
MoD3: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MrA: Miami	Slight	Slight	Slight	Slight	Slight.
MpB2: Miamian	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Slight	Slight.
MpC: Miamian	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MpD: Miamian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MpE: Miamian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MuC3: Miamian	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MuD3: Miamian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Mx: Millsdale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MzA: Milton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight	Moderate: thin layer.
OcA: Ockley	Slight	Slight	Moderate: small stones.	Slight	Slight.
OcB2: Ockley	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Pn: Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Px*. Pits					
RuB: Russell	Slight	Slight	Moderate: slope.	Slight	Slight.
Sh: Shoals	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Sm: Sleeth	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
So: Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
St: Stonelick	Severe: flooding.	Moderate: flooding, small stones.	Severe: small stones, flooding.	Moderate: flooding.	Severe: flooding.
Tr: Treaty	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ws: Westland	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
WwB2: Williamstown	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
XeB: Xenia	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
CeB2: Celina	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CrA: Crosby	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Cy: Cyclone	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
EdB2: Eldean	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ElC3: Eldean	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ElD3: Eldean	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
FnA: Fincastle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ge: Genesee	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
MmB2: Miami	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MmD: Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MmE: Miami	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
MoC3: Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MoD3: Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MrA: Miami	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MpB2: Miamian	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MpC: Miamian	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MpD: Miamian	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MpE: Miamian	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MuC3: Miamian	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MuD3: Miamian	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Mx: Millsdale	Fair	Fair	Fair	Fair	Poor	Good	Fair	Fair	Fair	Fair.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
MzA----------------- Milton	Good	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
OcA, OcB2----------- Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Pn------------------ Patton	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Px*. Pits										
RuB----------------- Russell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sh------------------ Shoals	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Sm------------------ Sleeth	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
So------------------ Sloan	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
St------------------ Stonelick	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Tr------------------ Treaty	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ws------------------ Westland	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WwB2---------------- Williamstown	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
XeB----------------- Xenia	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CeB2 Celina	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
CrA Crosby	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Cy Cyclone	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
EdB2 Eldean	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: droughty.
ElC3 Eldean	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: droughty, slope.
ElD3 Eldean	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
FnA Fincastle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ge Genesee	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
MmB2 Miami	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
MmD, MmE Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MoC3 Miami	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MoD3 Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MrA Miami	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
MpB2 Miamian	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Slight	Moderate: slope.	Moderate: frost action.	Slight.
MpC Miamian	Moderate: too clayey, dense layer, slope.	Moderate: slope, shrink-swell.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
MpD, MpE Miamian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
MuC3: Miamian	Moderate: too clayey, dense layer, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
MuD3: Miamian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mx: Millsdale	Severe: depth to rock, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, depth to rock, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
MzA: Milton	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.	Moderate: thin layer.
OcA: Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
OcB2: Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
Pn: Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Px*. Pits						
RuB: Russell	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Sh: Shoals	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
Sm: Sleeth	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
So: Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
St: Stonelick	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Tr: Treaty	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Ws: Westland	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
WwB2: Williamstown	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
XeB: Xenia	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CeB2----------------- Celina	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey.
CrA------------------ Crosby	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
Cy------------------- Cyclone	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
EdB2----------------- Eldean	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ElC3----------------- Eldean	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ElD3----------------- Eldean	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
FnA------------------ Fincastle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ge------------------- Genesee	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness, thin layer.
MmB2----------------- Miami	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
MmD, MmE------------ Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MoC3----------------- Miami	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MoD3----------------- Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MrA------------------ Miami	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too clayey, thin layer.
MpB2----------------- Miamian	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Fair: small stones.
MpC------------------ Miamian	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MpD, MpE: Miamian	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MuC3: Miamian	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
MuD3: Miamian	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Mx: Millsdale	Severe: depth to rock, ponding, percs slowly.	Severe: depth to rock, ponding.	Severe: depth to rock, ponding, too clayey.	Severe: depth to rock, ponding.	Poor: too clayey, area reclaim, hard to pack.
MzA: Milton	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey.
OcA, OcB2: Ockley	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: small stones.
Pn: Patton	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Px*. Pits					
RuB: Russell	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Sh: Shoals	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Sm: Sleeth	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
So: Sloan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
St: Stonelick	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: seepage.
Tr: Treaty	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Ws: Westland	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
WwB2: Williamstown	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
XeB: Xenia	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CeB2 Celina	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CrA Crosby	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Cy Cyclone	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
EdB2, ElC3 Eldean	Good	Probable	Probable	Poor: small stones, area reclaim.
ElD3 Eldean	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
FnA Fincastle	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ge Genesee	Good	Probable	Probable	Good.
MmB2 Miami	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
MmD Miami	Fair: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MmE Miami	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MoC3 Miami	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
MoD3 Miami	Fair: slope, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MrA Miami	Good	Probable	Probable	Fair: small stones, area reclaim.
MpB2 Miamian	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MpC Miamian	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
MpD Miamian	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MpE Miamian	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MuC3: Miamian	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
MuD3: Miamian	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Mx: Millsdale	Poor: low strength, depth to rock, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
MzA: Milton	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
OcA, OcB2: Ockley	Good	Probable	Probable	Poor: small stones, area reclaim.
Pn: Patton	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Px*. Pits				
RuB: Russell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Sh: Shoals	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Sm: Sleeth	Fair: wetness.	Probable	Probable	Poor: area reclaim.
So: Sloan	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
St: Stonelick	Good	Probable	Improbable: too sandy.	Poor: small stones.
Tr: Treaty	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ws: Westland	Poor: wetness.	Probable	Probable	Poor: wetness, small stones, area reclaim.
WwB2: Williamstown	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
XeB: Xenia	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
CeB2 Celina	Moderate: slope.	Severe: no water.	Frost action, slope.	Wetness, slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
CrA Crosby	Slight	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
Cy Cyclone	Moderate: seepage.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
EdB2 Eldean	Severe: seepage.	Severe: no water.	Deep to water	Droughty, slope, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.
ElC3, ElD3 Eldean	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, slope, erodes easily.	Slope, erodes easily, too sandy.	Slope, erodes easily, droughty.
FnA Fincastle	Moderate: seepage.	Severe: slow refill.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
Ge Genesee	Severe: seepage.	Moderate: deep to water, slow refill.	Deep to water	Flooding	Favorable	Favorable.
MmB2 Miami	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
MmD, MmE, MoC3, MoD3 Miami	Severe: slope.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
MrA Miami	Severe: seepage.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
MpB2 Miamian	Moderate: slope.	Severe: no water.	Deep to water	Rooting depth, slope, erodes easily.	Erodes easily	Erodes easily, rooting depth.
MpC, MpD, MpE, MuC3, MuD3 Miamian	Severe: slope.	Severe: no water.	Deep to water	Rooting depth, slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Mx Millsdale	Moderate: depth to rock.	Severe: no water.	Depth to rock, frost action, ponding.	Ponding, depth to rock.	Depth to rock, ponding.	Wetness, depth to rock.
MzA Milton	Moderate: seepage, depth to rock, slope.	Severe: no water.	Deep to water	Depth to rock, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
OcA Ockley	Severe: seepage.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
OcB2 Ockley	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily, slope.	Erodes easily.
Pn Patton	Slight	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Px*. Pits						
RuB----------------- Russell	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily, slope.	Erodes easily.
Sh----------------- Shoals	Moderate: seepage.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
Sm----------------- Sleeth	Severe: seepage.	Severe: cutbanks cave.	Frost action---	Wetness---------	Wetness---------	Wetness.
So----------------- Sloan	Slight----------	Severe: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
St----------------- Stonelick	Severe: seepage.	Severe: no water.	Deep to water	Droughty, flooding.	Too sandy, soil blowing.	Droughty.
Tr----------------- Treaty	Moderate: seepage.	Severe: slow refill.	Ponding, frost action.	Ponding---------	Ponding, erodes easily.	Wetness, erodes easily.
Ws----------------- Westland	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding---------	Ponding---------	Wetness.
WwB2--------------- Williamstown	Moderate: seepage, slope.	Severe: no water.	Frost action, slope.	Wetness, slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
XeB---------------- Xenia	Moderate: seepage, slope.	Severe: slow refill.	Frost action---	Wetness, erodes easily, slope.	Erodes easily, wetness.	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
CeB2----------- Celina	0-7	Silt loam--------	ML	A-4	0	100	90-100	90-100	70-85	26-40	3-10
	7-32	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	100	90-100	80-95	70-85	32-48	12-28
	32-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	75-95	75-90	65-90	50-80	20-36	4-16
CrA------------ Crosby	0-14	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	22-34	6-15
	14-36	Clay loam, silty clay loam.	CL, CH	A-6, A-7	0-3	92-99	89-97	78-93	64-76	37-55	17-31
	36-60	Loam, clay loam, sandy loam.	CL, ML, CL-ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	17-30	2-14
Cy------------- Cyclone	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	12-25
	10-54	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	15-30
	54-68	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-95	50-80	25-40	4-15
	68-80	Loam-------------	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	50-75	20-30	6-15
EdB2----------- Eldean	0-8	Loam-------------	ML, CL-ML, CL	A-4, A-6	0	85-100	80-100	70-100	55-90	20-40	4-14
	8-28	Clay, gravelly sandy clay, gravelly clay loam.	CL, ML	A-7, A-6	0-5	75-100	60-100	55-95	50-80	38-50	12-23
	28-33	Gravelly clay loam, loam, sandy clay loam.	CL, GC, SC	A-4, A-6, A-7, A-2	0-10	55-85	45-85	45-75	30-60	30-45	8-20
	33-60	Stratified sand to gravel.	GM, SM, GP-GM, SP-SM	A-1, A-2	0-15	30-70	20-50	5-40	0-35	---	NP
ElC3, ElD3------- Eldean	0-8	Clay loam--------	CL	A-6, A-4	0-5	85-100	75-100	65-100	55-80	25-40	9-18
	8-26	Gravelly clay loam, loam, gravelly sandy loam.	CL, GC, SC	A-4, A-6, A-7, A-2	0-10	55-85	45-85	45-75	30-60	30-45	8-20
	26-60	Stratified sand to gravel.	GM, SM, GP-GM, SP-SM	A-1, A-2	0-15	30-70	20-50	5-40	0-35	---	NP
FnA------------ Fincastle	0-13	Silt loam--------	CL, ML, CL-ML	A-4	0	100	95-100	90-100	75-93	<25	3-10
	13-27	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-15
	27-50	Clay loam, loam, silty clay loam.	CL	A-6	0	95-100	90-98	85-95	75-85	30-40	10-15
	50-60	Loam-------------	CL	A-4, A-6	0-3	88-96	82-90	70-86	50-66	25-30	8-11
Ge------------- Genesee	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-30	5-11
	8-34	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-30	5-11
	34-55	Silt loam, loam	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	<25	3-8
	55-60	Stratified gravelly coarse sand to coarse sand.	GP, GP-GM, SP, SP-SM	A-1	0	30-55	25-45	10-35	1-10	---	NP
MmB2, MmD, MmE--- Miami	0-9	Silt loam--------	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	9-29	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	29-60	Loam, clay loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
MoC3, MoD3-------- Miami	0-9	Clay loam--------	CL	A-6	0	100	90-100	75-95	65-95	30-40	15-20
	9-29	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	29-60	Loam, clay loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
MrA--------------- Miami	0-10	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	70-90	20-30	6-15
	10-39	Silty clay loam, clay loam.	CL	A-6	0	100	90-100	80-100	65-95	30-40	10-20
	39-60	Stratified gravelly sand to very gravelly coarse sand.	GP, GP-GM, SP, SP-SM	A-1	0-3	40-55	30-50	15-35	2-10	---	NP
MpB2, MpC, MpD, MpE--------------- Miamian	0-9	Silt loam--------	ML	A-4, A-6	0	95-100	95-100	90-100	70-95	26-40	4-12
	9-32	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0-5	85-100	80-100	75-95	70-85	32-50	15-30
	32-60	Loam, silt loam	CL, ML, CL-ML	A-4, A-6	0-5	75-95	75-90	65-85	50-75	20-35	3-13
MuC3, MuD3-------- Miamian	0-7	Clay loam--------	CL	A-6, A-7	0	90-100	85-100	75-95	70-90	30-45	15-25
	7-30	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0-5	85-100	80-100	75-95	70-85	32-50	15-30
	30-60	Loam, silt loam	CL, ML, CL-ML	A-4, A-6	0-5	75-95	75-90	65-85	50-75	20-35	3-13
Mx---------------- Millsdale	0-10	Silty clay loam	CL	A-6, A-7	0	90-100	80-100	75-100	60-95	32-50	12-25
	10-28	Silty clay, silty clay loam, channery silt loam.	CH, CL	A-7, A-2-7	0-5	35-95	25-95	15-95	15-90	40-60	20-35
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MzA--------------- Milton	0-19	Silt loam--------	ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-95	26-36	4-12
	19-28	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0	95-100	80-100	75-100	70-95	32-48	12-28
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
OcA, OcB2--------- Ockley	0-18	Silt loam--------	CL, ML, CL-ML	A-4	0	95-100	85-100	70-100	50-90	15-30	3-10
	18-37	Silty clay loam, clay loam, silt loam, sandy clay loam.	CL	A-6, A-4	0	90-100	80-100	70-90	55-90	25-40	8-15
	37-49	Gravelly clay loam, gravelly sandy clay loam.	CL, SC	A-6, A-4, A-2	0-2	70-85	45-85	40-70	25-55	25-40	8-15
	49-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	10-40	2-10	---	NP
Pn---------------- Patton	0-10	Silty clay loam	CL	A-6	0	100	100	95-100	75-95	30-40	15-25
	10-25	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-100	40-55	15-25
	25-60	Stratified silt loam to silty clay loam.	CL	A-6	0	100	100	95-100	75-95	25-40	10-20
Px*. Pits											
RuB--------------- Russell	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	5-15
	8-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	15-25
	27-47	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-95	80-90	60-80	35-45	15-25
	47-60	Loam-------------	CL, CL-ML	A-4, A-6	0-3	85-95	80-90	75-85	50-65	20-30	5-12

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sh----------------- Shoals	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	6-15
	9-50	Silt loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	5-15
	50-60	Stratified silt loam to sand.	ML, CL, CL-ML	A-4	0-3	90-100	85-100	60-80	50-70	<30	4-10
Sm----------------- Sleeth	0-8	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	90-100	75-95	50-85	20-35	3-15
	8-39	Clay loam, silty clay loam, sandy clay loam, silt loam.	CL	A-6	0	85-95	85-95	80-90	65-75	30-40	15-25
	39-44	Gravelly clay loam, gravelly sandy clay loam, gravelly loam.	CL	A-6	0-3	65-95	60-85	55-70	50-70	30-40	15-25
	44-60	Stratified sand to gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
So----------------- Sloan	0-13	Silt loam--------	CL	A-6, A-7	0	100	95-100	85-100	70-95	35-45	12-20
	13-56	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	56-60	Stratified sandy loam to silt loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
St----------------- Stonelick	0-12	Sandy loam-------	SM, ML, SM-SC, CL-ML	A-4, A-2	0	85-100	70-100	45-75	25-55	<24	NP-6
	12-60	Stratified sandy loam to gravelly loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-b	0-3	40-95	35-90	20-60	5-40	<15	NP
Tr----------------- Treaty	0-11	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	12-25
	11-36	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	15-30
	36-48	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0	95-100	85-100	75-95	55-85	28-48	12-25
	48-60	Loam-------------	CL-ML, CL	A-4, A-6	0	90-100	85-95	75-90	55-75	20-30	6-15
Ws----------------- Westland	0-11	Clay loam--------	CL	A-6, A-7	0	100	95-100	90-100	75-90	30-45	10-25
	11-40	Clay loam--------	CL	A-6, A-7	0	95-100	90-100	80-90	65-75	35-50	15-30
	40-54	Gravelly clay loam, gravelly sandy loam.	CL	A-6, A-7	0-5	65-75	60-70	55-70	50-70	30-50	15-30
	54-60	Stratified sand to gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
WwB2--------------- Williamstown	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	4-15
	9-30	Clay loam, silty clay loam.	CL	A-6	0	100	95-100	85-100	70-95	30-40	10-20
	30-60	Loam-------------	ML, CL-ML, CL	A-4, A-6	0-2	100	95-100	80-95	55-75	20-35	3-11
XeB---------------- Xenia	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	10-26	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	26-50	Clay loam--------	CL	A-6, A-7	0-5	92-100	90-95	75-95	65-75	35-50	15-30
	50-60	Loam-------------	CL, ML, SC, SM	A-4, A-6	0-5	85-95	80-90	75-90	40-65	15-30	NP-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cm3	In/hr	In/in	pH					Pct
CeB2	0-7	14-26	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	6	1-3
Celina	7-32	35-48	1.45-1.70	0.2-0.6	0.16-0.19	4.5-7.8	Moderate	0.37			
	32-60	16-27	1.60-1.82	0.2-0.6	0.06-0.10	7.4-8.4	Low	0.37			
CrA	0-14	11-22	1.40-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low	0.43	3	5	1-3
Crosby	14-36	35-45	1.50-1.70	0.06-0.2	0.15-0.20	5.1-7.3	Moderate	0.43			
	36-60	15-32	1.70-2.00	0.06-0.6	0.05-0.19	7.9-8.4	Low	0.43			
Cy	0-10	27-33	1.40-1.60	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.28	5	7	4-6
Cyclone	10-54	27-35	1.40-1.60	0.6-2.0	0.18-0.20	6.1-7.8	Moderate	0.43			
	54-68	15-25	1.40-1.60	0.6-2.0	0.15-0.19	6.6-8.4	Low	0.43			
	68-80	15-25	1.50-1.80	0.2-0.6	0.05-0.19	7.4-8.4	Low	0.43			
EdB2	0-8	15-25	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Low	0.37	4	5	1-3
Eldean	8-28	35-48	1.40-1.60	0.2-2.0	0.08-0.14	5.1-6.5	Moderate	0.37			
	28-33	25-45	1.30-1.60	0.6-2.0	0.07-0.14	6.6-8.4	Low	0.37			
	33-60	2-8	---	>6.0	0.01-0.04	7.4-8.4	Low	0.10			
ElC3, ElD3	0-8	27-33	1.35-1.55	0.6-2.0	0.16-0.18	5.6-7.3	Low	0.37	3	6	.5-2
Eldean	8-26	25-45	1.30-1.60	0.6-2.0	0.07-0.14	6.6-8.4	Low	0.37			
	26-60	2-8	---	>6.0	0.01-0.04	7.4-8.4	Low	0.10			
FnA	0-13	11-22	1.40-1.55	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	5	1-3
Fincastle	13-27	23-35	1.45-1.65	0.6-2.0	0.18-0.20	5.1-6.0	Moderate	0.37			
	27-50	24-32	1.45-1.65	0.6-2.0	0.15-0.19	5.1-7.8	Moderate	0.37			
	50-60	20-26	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Low	0.37			
Ge	0-8	17-25	1.30-1.50	0.6-2.0	0.20-0.24	6.6-7.8	Low	0.32	5	5	1-3
Genesee	8-34	17-25	1.30-1.60	0.6-2.0	0.17-0.22	6.6-8.4	Low	0.32			
	34-55	10-20	1.30-1.60	0.6-2.0	0.17-0.22	6.6-8.4	Low	0.32			
	55-60	0-5	1.50-1.70	>20	0.01-0.04	7.4-8.4	Low	0.10			
MmB2, MmD, MmE	0-9	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	.5-3
Miami	9-29	25-35	1.45-1.65	0.6-2.0	0.15-0.20	5.6-6.0	Moderate	0.37			
	29-60	15-30	1.55-1.90	0.2-0.6	0.05-0.19	6.6-8.4	Moderate	0.37			
MoC3, MoD3	0-9	27-35	1.35-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.37	4	6	.5-3
Miami	9-29	25-35	1.45-1.65	0.6-2.0	0.15-0.20	5.6-6.0	Moderate	0.37			
	29-60	15-30	1.55-1.90	0.2-0.6	0.05-0.19	6.6-8.4	Moderate	0.37			
MrA	0-10	18-25	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.37	5	6	1-3
Miami	10-39	27-35	1.35-1.45	0.6-2.0	0.18-0.21	5.6-6.5	Moderate	0.37			
	39-60	0-2	1.65-1.80	6.0-20	0.01-0.02	7.4-8.4	Low	0.10			
MpB2, MpC, MpD, MpE	0-9	14-27	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	6	1-3
Miamian	9-32	35-48	1.45-1.70	0.2-0.6	0.12-0.18	4.5-7.8	Moderate	0.37			
	32-60	16-31	1.60-1.82	0.2-0.6	0.06-0.10	7.4-8.4	Low	0.37			
MuC3, MuD3	0-7	27-32	1.35-1.55	0.2-0.6	0.17-0.23	5.6-7.3	Moderate	0.37	4	6	.5-2
Miamian	7-30	35-48	1.45-1.70	0.2-0.6	0.12-0.18	4.5-7.8	Moderate	0.37			
	30-60	16-31	1.60-1.82	0.2-0.6	0.06-0.10	7.4-8.4	Low	0.37			
Mx	0-10	27-32	1.30-1.50	0.6-2.0	0.19-0.22	6.5-7.8	Moderate	0.32	4	6	4-7
Millsdale	10-28	35-45	1.40-1.70	0.2-0.6	0.12-0.16	6.5-8.4	High	0.32			
	28	---	---	---	---	---	---	----			
MzA	0-19	10-25	1.30-1.50	0.6-2.0	0.18-0.23	6.6-7.8	Low	0.37	4	6	1-3
Milton	19-28	35-50	1.45-1.70	0.2-0.6	0.12-0.18	6.6-7.8	Moderate	0.37			
	28	---	---	---	---	---	---	----			

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cm^3	In/hr	In/in	pH					Pct
OcA, OcB2-------- Ockley	0-18	11-22	1.30-1.45	0.6-2.0	0.20-0.24	6.1-6.5	Low-----------	0.37	5	5	.5-3
	18-37	20-35	1.45-1.60	0.6-2.0	0.15-0.22	5.1-6.0	Moderate-----	0.37			
	37-49	20-35	1.40-1.55	0.6-2.0	0.06-0.11	5.6-7.3	Moderate-----	0.24			
	49-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Pn--------------- Patton	0-10	27-35	1.15-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Moderate-----	0.28	5	7	4-5
	10-25	27-35	1.25-1.45	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.28			
	25-60	22-35	1.30-1.50	0.2-0.6	0.18-0.22	7.4-8.4	Moderate-----	0.28			
Px*. Pits											
RuB-------------- Russell	0-8	11-25	1.30-1.45	0.6-2.0	0.21-0.24	5.1-7.3	Low-----------	0.37	5	5	.5-2
	8-27	25-33	1.40-1.60	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
	27-47	23-33	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.37			
	47-60	14-27	1.60-1.80	0.6-2.0	0.05-0.19	7.4-8.4	Low-----------	0.37			
Sh--------------- Shoals	0-9	18-27	1.30-1.50	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.37	5	5	2-5
	9-50	18-33	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low-----------	0.37			
	50-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-8.4	Low-----------	0.37			
Sm--------------- Sleeth	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	6.6-7.3	Low-----------	0.32	5	5	.5-3
	8-39	20-35	1.45-1.60	0.6-2.0	0.15-0.19	5.6-6.5	Moderate-----	0.32			
	39-44	20-35	1.40-1.60	0.6-2.0	0.14-0.16	6.6-8.4	Moderate-----	0.32			
	44-60	2-5	1.60-1.80	>20	0.02-0.04	7.9-8.4	Low-----------	0.10			
So--------------- Sloan	0-13	18-27	1.25-1.50	0.6-2.0	0.18-0.22	6.1-7.8	Moderate-----	0.37	5	6	3-6
	13-56	22-35	1.25-1.55	0.2-0.6	0.15-0.19	6.1-8.4	Moderate-----	0.37			
	56-60	10-30	1.20-1.50	0.2-0.6	0.13-0.18	6.6-8.4	Low-----------	0.37			
St--------------- Stonelick	0-12	8-18	1.25-1.50	2.0-6.0	0.09-0.14	7.4-8.4	Low-----------	0.24	5	3	1-3
	12-60	5-18	1.20-1.55	2.0-6.0	0.05-0.11	7.4-8.4	Low-----------	0.24			
Tr--------------- Treaty	0-11	28-35	1.40-1.60	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.32	5	7	4-6
	11-36	28-35	1.50-1.70	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
	36-48	20-35	1.50-1.70	0.6-2.0	0.15-0.19	6.6-7.8	Moderate-----	0.43			
	48-60	15-27	1.70-1.90	0.2-0.6	0.17-0.19	7.4-8.4	Low-----------	0.43			
Ws--------------- Westland	0-11	27-35	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	7	2-6
	11-40	27-35	1.45-1.60	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.28			
	40-54	15-30	1.40-1.60	0.6-2.0	0.14-0.16	5.6-7.3	Moderate-----	0.28			
	54-60	1-7	1.50-1.75	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
WwB2------------- Williamstown	0-9	14-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	9-30	27-35	1.35-1.50	0.6-2.0	0.15-0.21	5.6-7.3	Moderate-----	0.37			
	30-60	16-26	1.45-1.70	0.2-0.6	0.05-0.19	7.4-8.4	Low-----------	0.37			
XeB-------------- Xenia	0-10	11-22	1.40-1.55	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.37	5	5	1-3
	10-26	27-35	1.45-1.65	0.2-0.6	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	26-50	27-35	1.45-1.65	0.2-0.6	0.15-0.19	5.1-7.3	Moderate-----	0.37			
	50-60	20-27	1.55-1.90	0.2-2.0	0.05-0.19	7.9-8.4	Low-----------	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
CeB2--------------- Celina	C	None---------	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	High-----	High-----	Moderate.
CrA---------------- Crosby	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
Cy----------------- Cyclone	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
EdB2, ElC3, ElD3-- Eldean	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
FnA---------------- Fincastle	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
Ge----------------- Genesee	B	Frequent----	Brief-----	Nov-May	3.0-6.0	Apparent	Jan-Apr	>60	---	Moderate	Low------	Low.
MmB2, MmD, MmE, MoC3, MoD3, MrA-- Miami	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MpB2, MpC, MpD, MpE, MuC3, MuD3-- Miamian	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Mx----------------- Millsdale	B/D	None---------	---	---	+1-1.0	Perched	Jan-Apr	20-40	Hard	High-----	High-----	Low.
MzA---------------- Milton	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Moderate.
OcA, OcB2--------- Ockley	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Pn----------------- Patton	B/D	None---------	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Low.
Px*. Pits												
RuB---------------- Russell	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
Sh----------------- Shoals	C	Frequent----	Brief-----	Oct-Jun	0.5-1.5	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.
Sm----------------- Sleeth	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
So----------------- Sloan	B/D	Frequent-----	Brief------	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.
St----------------- Stonelick	B	Frequent-----	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Tr----------------- Treaty	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High------	High------	Low.
Ws----------------- Westland	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High------	High------	Low.
WwB2--------------- Williamstown	C	None---------	---	---	1.5-3.5	Perched	Jan-Apr	>60	---	High------	Moderate	Low.
XeB---------------- Xenia	B	None---------	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High------	High------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Celina	Fine, mixed, mesic Aquic Hapludalfs
Crosby	Fine, mixed, mesic Aeric Ochraqualfs
Cyclone	Fine-silty, mixed, mesic Typic Argiaquolls
Eldean	Fine, mixed, mesic Typic Hapludalfs
Fincastle	Fine-silty, mixed, mesic Aeric Ochraqualfs
Genesee	Fine-loamy, mixed, nonacid, mesic Typic Udifluvents
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Miamian	Fine, mixed, mesic Typic Hapludalfs
Millsdale	Fine, mixed, mesic Typic Argiaquolls
Milton	Fine, mixed, mesic Typic Hapludalfs
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
Patton	Fine-silty, mixed, mesic Typic Haplaquolls
Russell	Fine-silty, mixed, mesic Typic Hapludalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
*Sleeth	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
*Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
Treaty	Fine-silty, mixed, mesic Typic Argiaquolls
Westland	Fine-loamy, mixed, mesic Typic Argiaquolls
Williamstown	Fine-loamy, mixed, mesic Aquic Hapludalfs
Xenia	Fine-silty, mixed, mesic Aquic Hapludalfs

* U.S. GOVERNMENT PRINTING OFFICE: 1985 O - 472-289 QL 3

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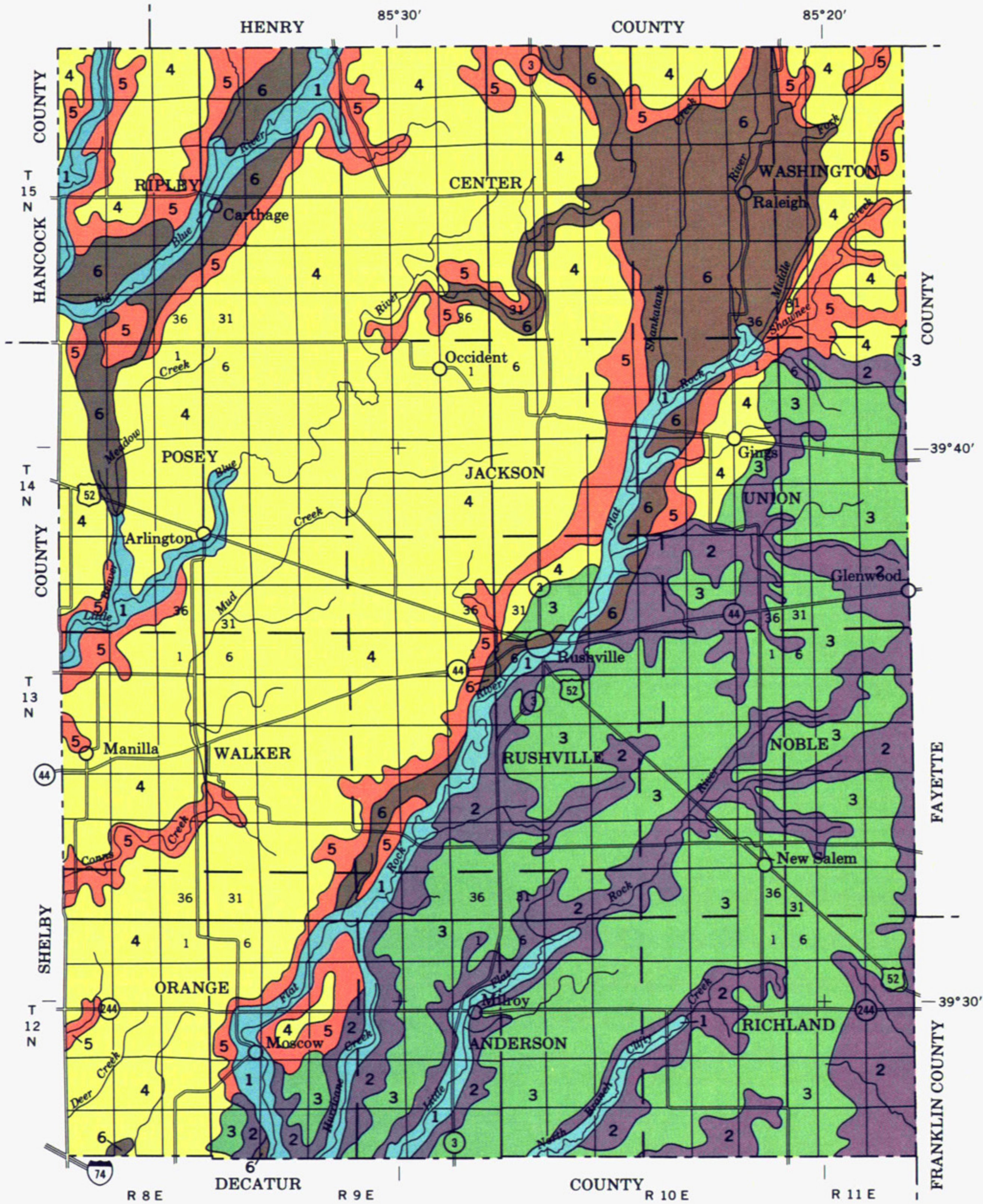


N

LEGEND

1 GENESEE-SLOAN-SHOALS: Deep, nearly level, well drained, very poorly drained, and somewhat poorly drained soils formed in alluvial deposits; on bottom land

2 MIAMI-XENIA-RUSSELL: Deep, nearly level to steep, well drained and moderately well drained soils formed in loess and the underlying glacial till; on uplands

3 FINCASTLE-CYCLONE-XENIA: Deep, nearly level and gently sloping, somewhat poorly drained, poorly drained, and moderately well drained soils formed in loess and the underlying glacial till; on uplands

4 CROSBY-TREATY: Deep, nearly level, somewhat poorly drained and very poorly drained soils formed in loess and the underlying glacial till; on uplands

5 MIAMIAN: Deep, gently sloping to steep, well drained soils formed in loess and the underlying glacial till; on uplands

6 OCKLEY-WESTLAND-SLEETH: Deep, nearly level and gently sloping, well drained, very poorly drained, and somewhat poorly drained soils formed in glacial outwash deposits; on terraces and outwash plains

Compiled 1983

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION AND
INDIANA DEPARTMENT OF NATURAL RESOURCES
SOIL AND WATER CONSERVATION COMMITTEE

GENERAL SOIL MAP

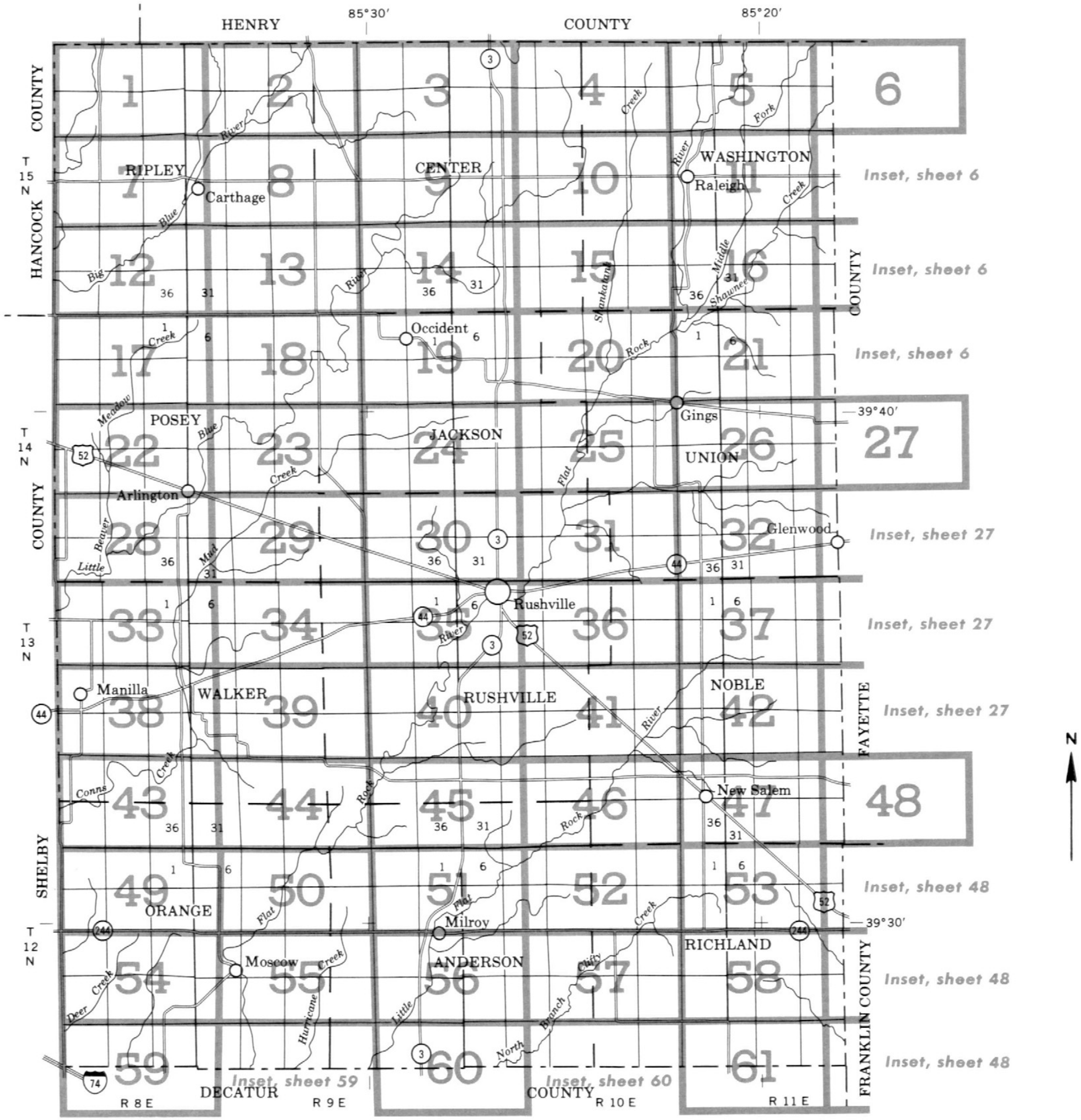
RUSH COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
This map is compiled on 1976 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

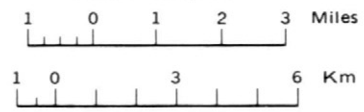
SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

RUSH COUNTY, INDIANA

Scale 1:190,080



SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
CeB2	Celina silt loam, 2 to 6 percent slopes, eroded
CrA	Crosby silt loam, 0 to 3 percent slopes
Cy	Cyclone silty clay loam
EdB2	Eldean loam, 2 to 6 percent slopes, eroded
ElC3	Eldean clay loam, 6 to 12 percent slopes, severely eroded
ElD3	Eldean clay loam, 12 to 18 percent slopes, severely eroded
FnA	Fincastle silt loam, 0 to 2 percent slopes
Ge	Genesee loam, gravelly substratum
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded
MmD	Miami silt loam, 12 to 18 percent slopes
MmE	Miami silt loam, 18 to 35 percent slopes
MoC3	Miami clay loam, 6 to 12 percent slopes, severely eroded
MoD3	Miami clay loam, 12 to 18 percent slopes, severely eroded
MrA	Miami silt loam, gravelly substratum, 0 to 2 percent slopes
MpB2	Miamian silt loam, 2 to 6 percent slopes, eroded
MpC	Miamian silt loam, 6 to 12 percent slopes
MpD	Miamian silt loam, 12 to 18 percent slopes
MpE	Miamian silt loam, 18 to 35 percent slopes
MuC3	Miamian clay loam, 6 to 12 percent slopes, severely eroded
MuD3	Miamian clay loam, 12 to 18 percent slopes, severely eroded
Mx	Millsdale silty clay loam
MzA	Milton silt loam, 0 to 3 percent slopes
OcA	Ockley silt loam, 0 to 2 percent slopes
OcB2	Ockley silt loam, 2 to 6 percent slopes, eroded
Pn	Patton silty clay loam
Px	Pits, quarry
RuB	Russell silt loam, 2 to 6 percent slopes
Sh	Shoals silt loam, frequently flooded
Sm	Sleeth silt loam
So	Sloan silt loam, frequently flooded
St	Stonelick sandy loam, frequently flooded
Tr	Treaty silty clay loam
Ws	Westland clay loam
WwB2	Williamstown silt loam, 2 to 6 percent slopes, eroded
XeB	Xenia silt loam, 1 to 4 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — Sm, MmB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

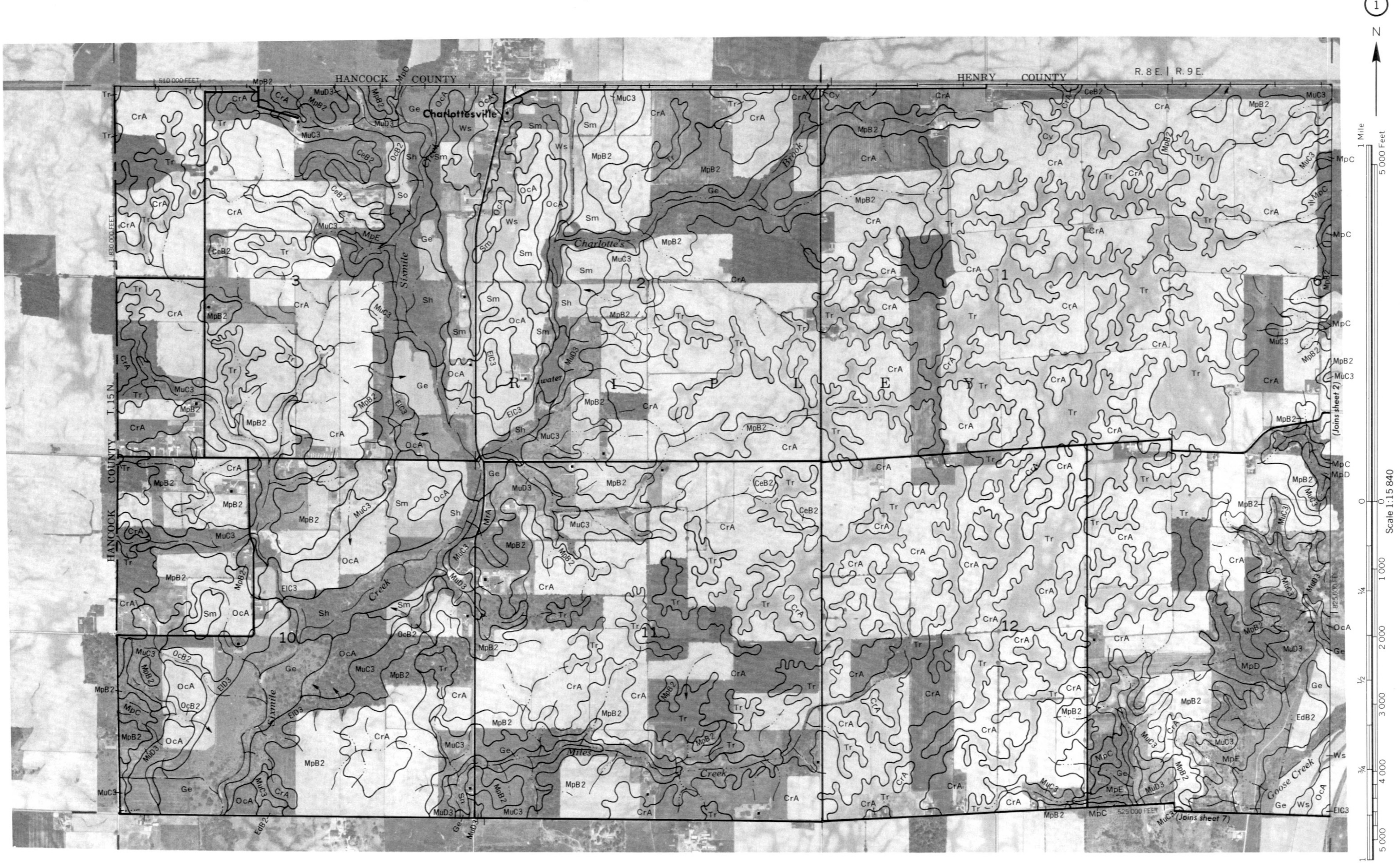
GULLY

DEPRESSION OR SINK

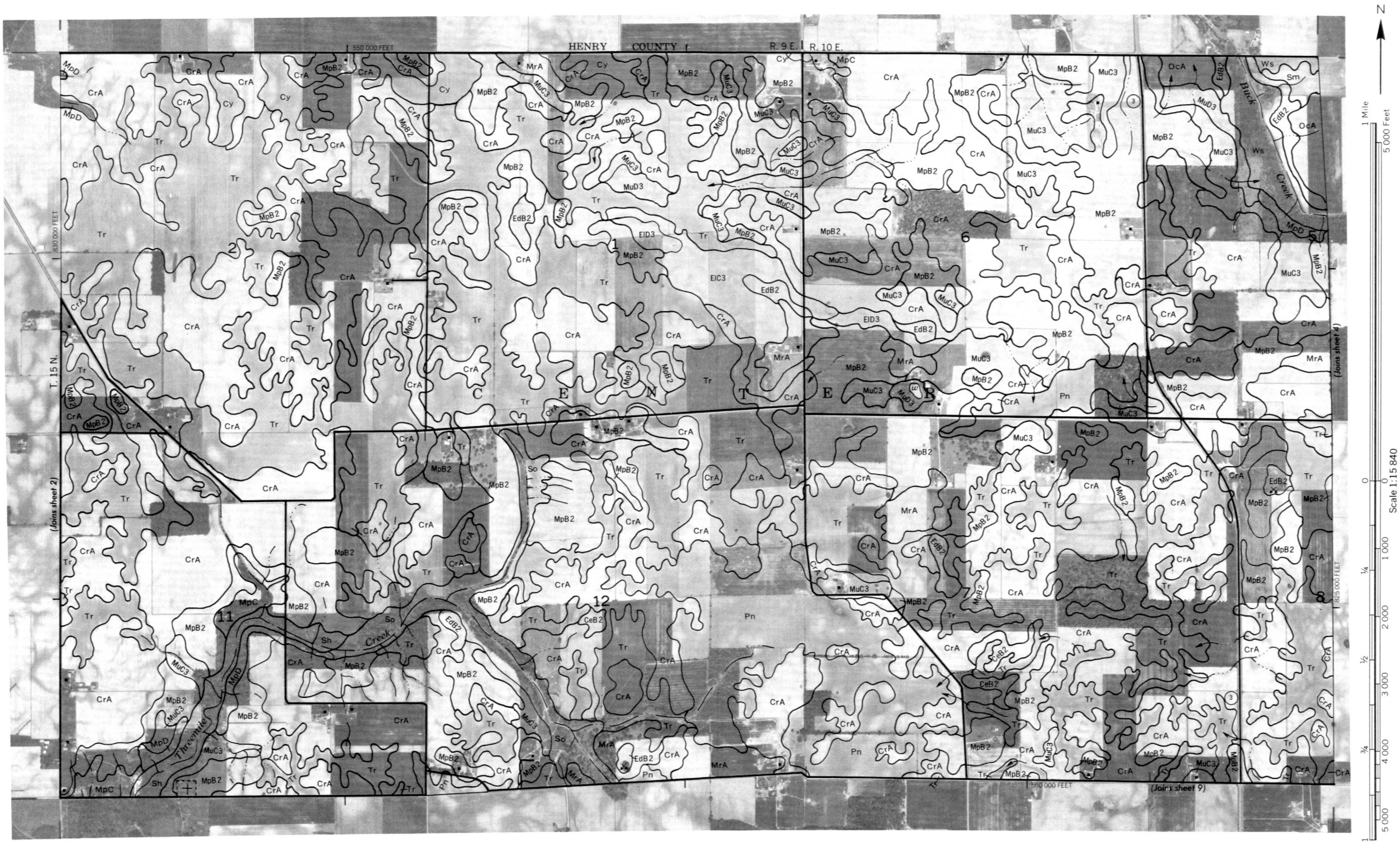
SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

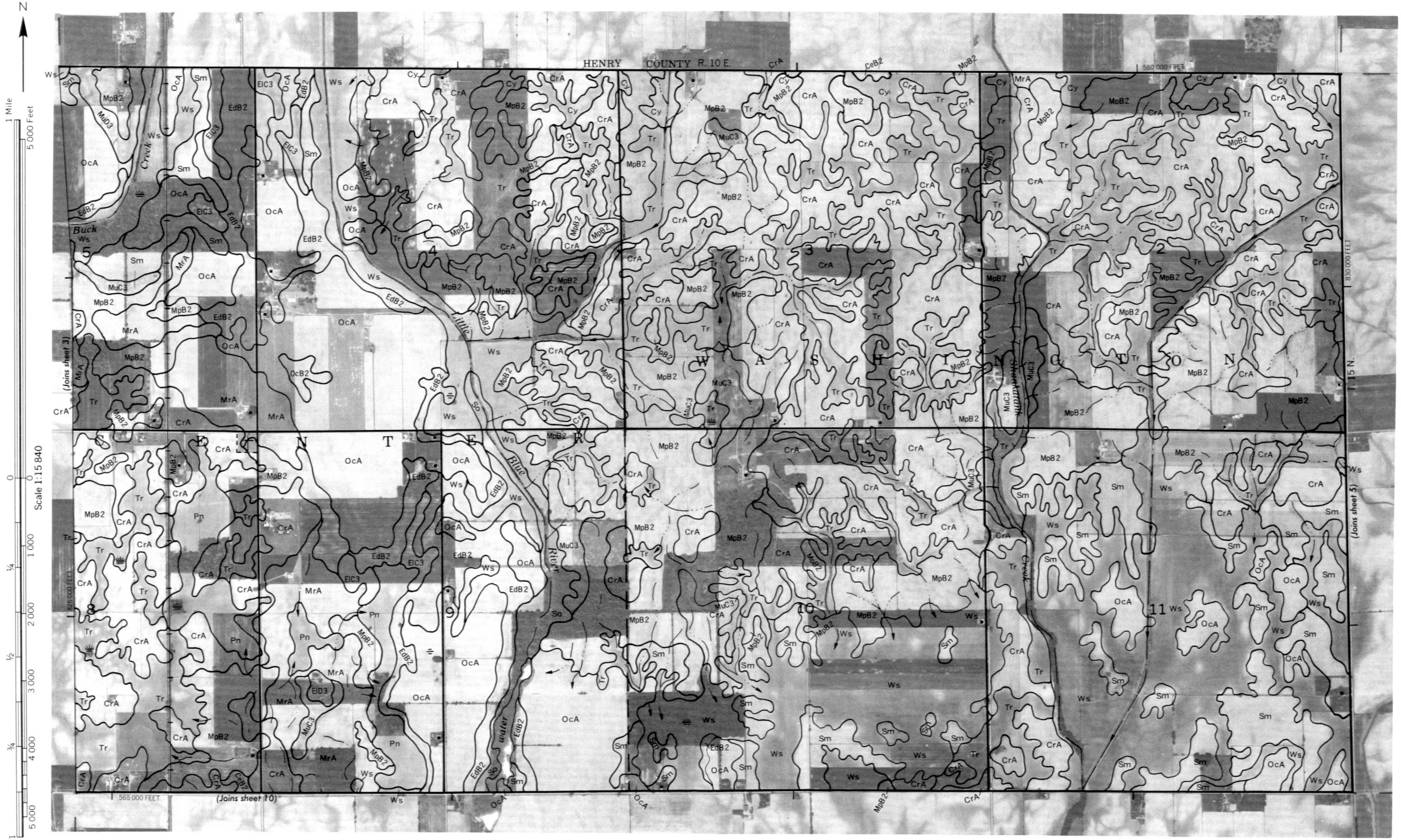

1
N
HANCOCK COUNTY
HENRY COUNTY
R. 8 E. | R. 9 E.
T. 15 N.
HANCOCK COUNTY
Charlottesville
Sixmile Creek
Charlotte's Brook
Miles Creek
Goose Creek
R I P L E Y
(Joins sheet 2)
(Joins sheet 7)
510 000 FEET
525 000 FEET
825 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

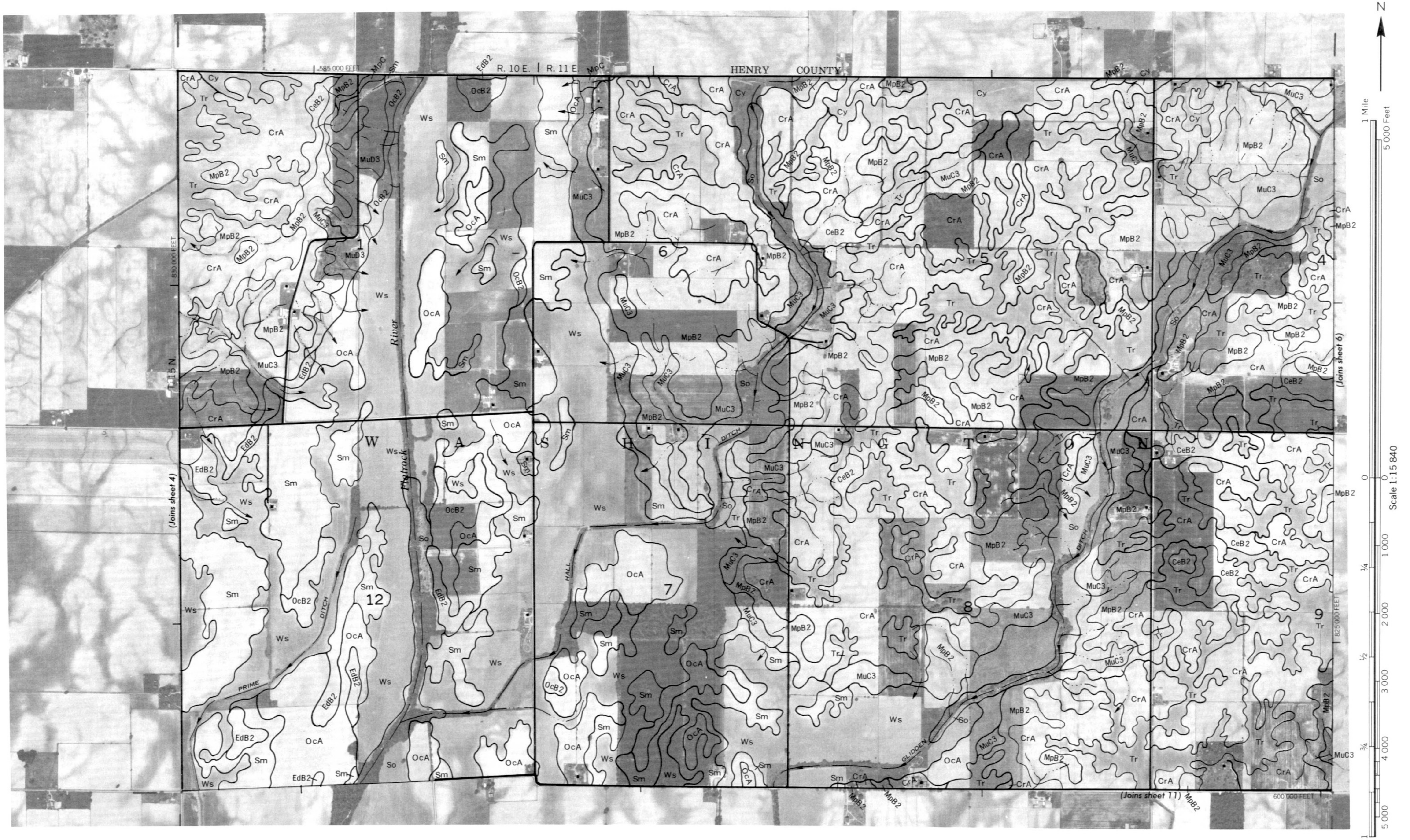

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5000
0
1/4
1/2
3/4
1
R. 9 E.
HENRY COUNTY
545 000 FEET
530 000 FEET
825 000 FEET
T. 15 N.
(Joins sheet 2)
(Joins sheet 3)
(Joins sheet 8)
R I P L E Y
T E T E
water
Goose Creek
York Run
Big Blue River
Threemile Creek
Bell Run
140


HENRY COUNTY
R. 9 E.
R. 10 E.
550 000 FEET
560 000 FEET
830 000 FEET
825 000 FEET
T. 15 N.
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
C E N T E R
Buck Creek
Threemile Creek
N
1 Mile
5 000 Feet
Scale 1:15 840

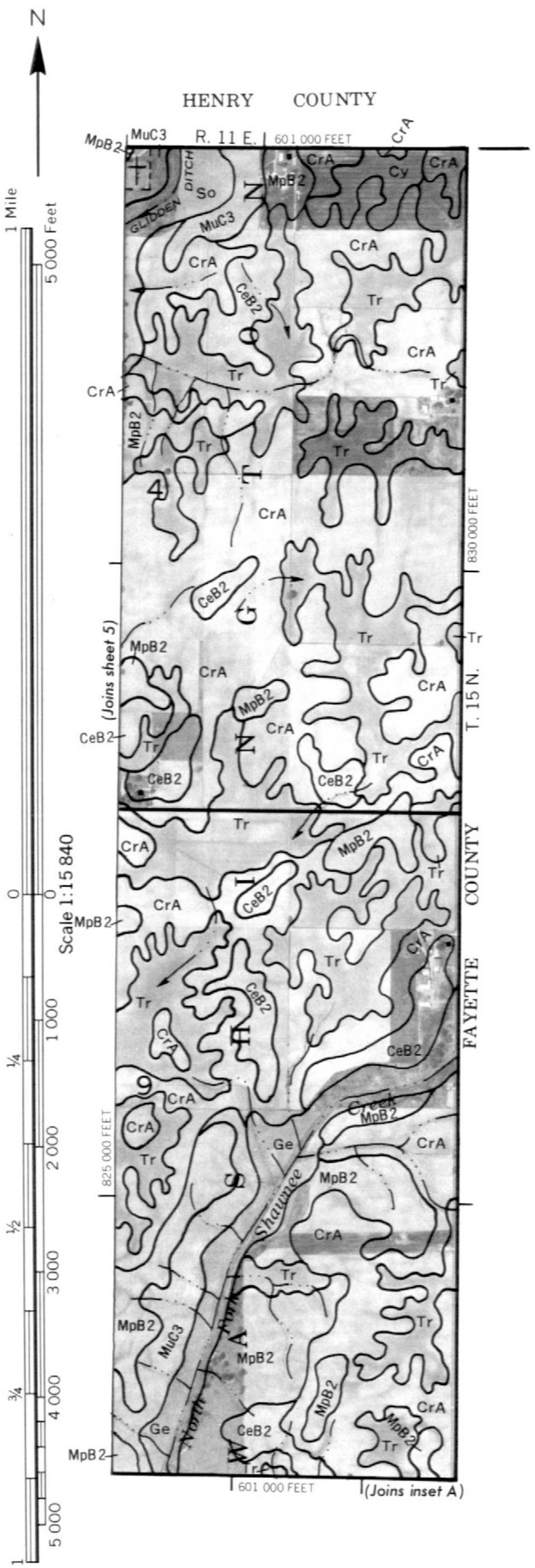
4

RUSH COUNTY, INDIANA — SHEET NUMBER 4

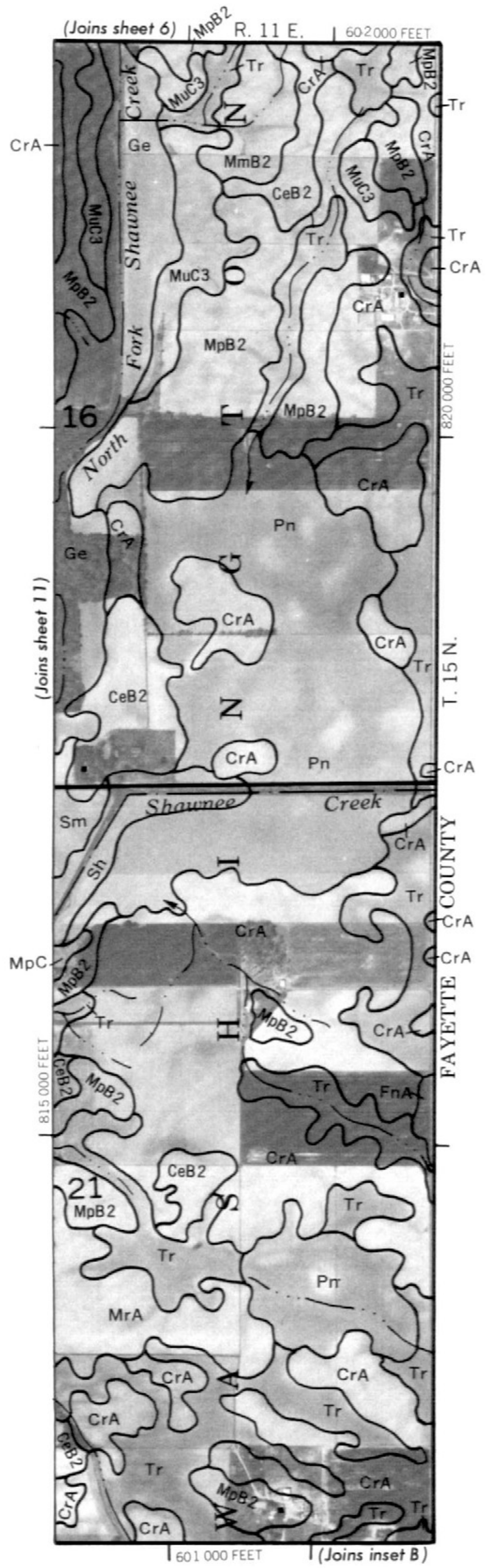



N
HENRY COUNTY
R. 10 E. | R. 11 E.
T. 15 N.
W A S H I N G T O N
Flatrock River
PRIME DITCH
HALL DITCH
GLIDDEN DITCH
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
585 000 FEET
600 000 FEET
830 000 FEET
825 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

RUSH COUNTY, INDIANA — SHEET NUMBER 6

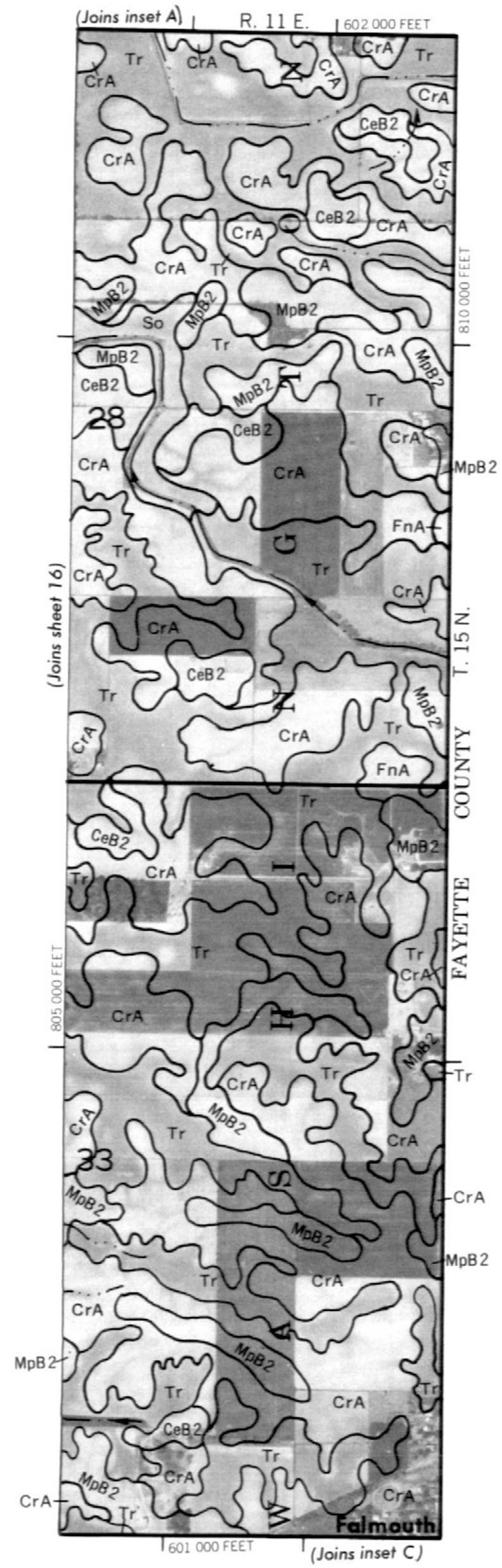


INSET A



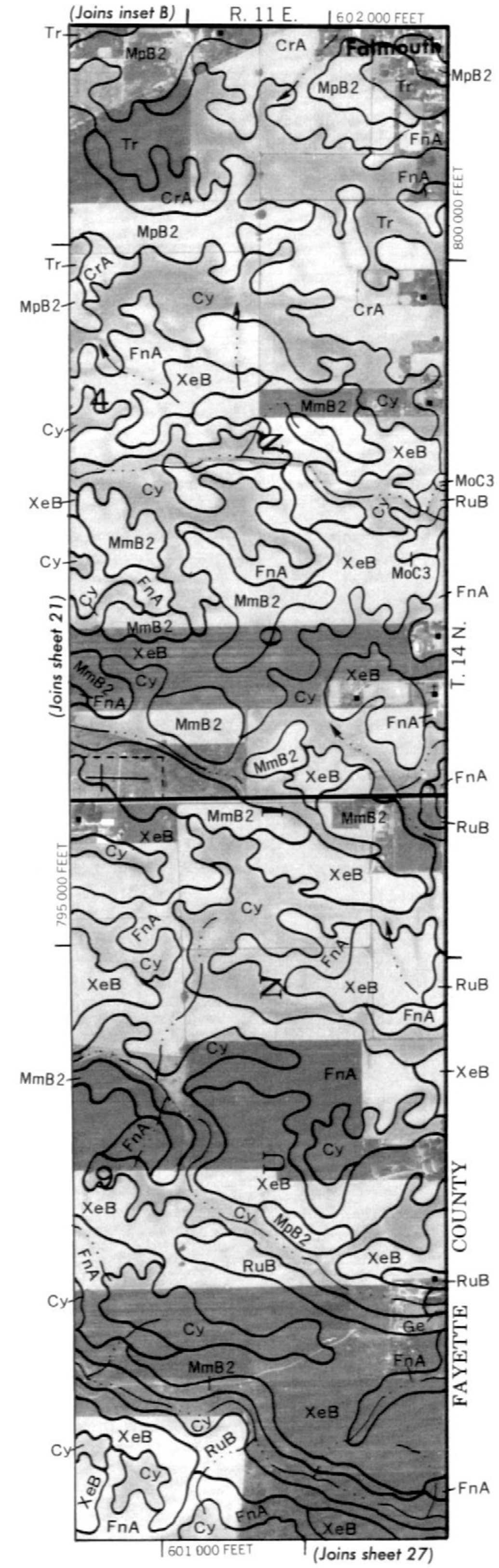
1000 AND 5000-FOOT GRID TICKS

INSET B

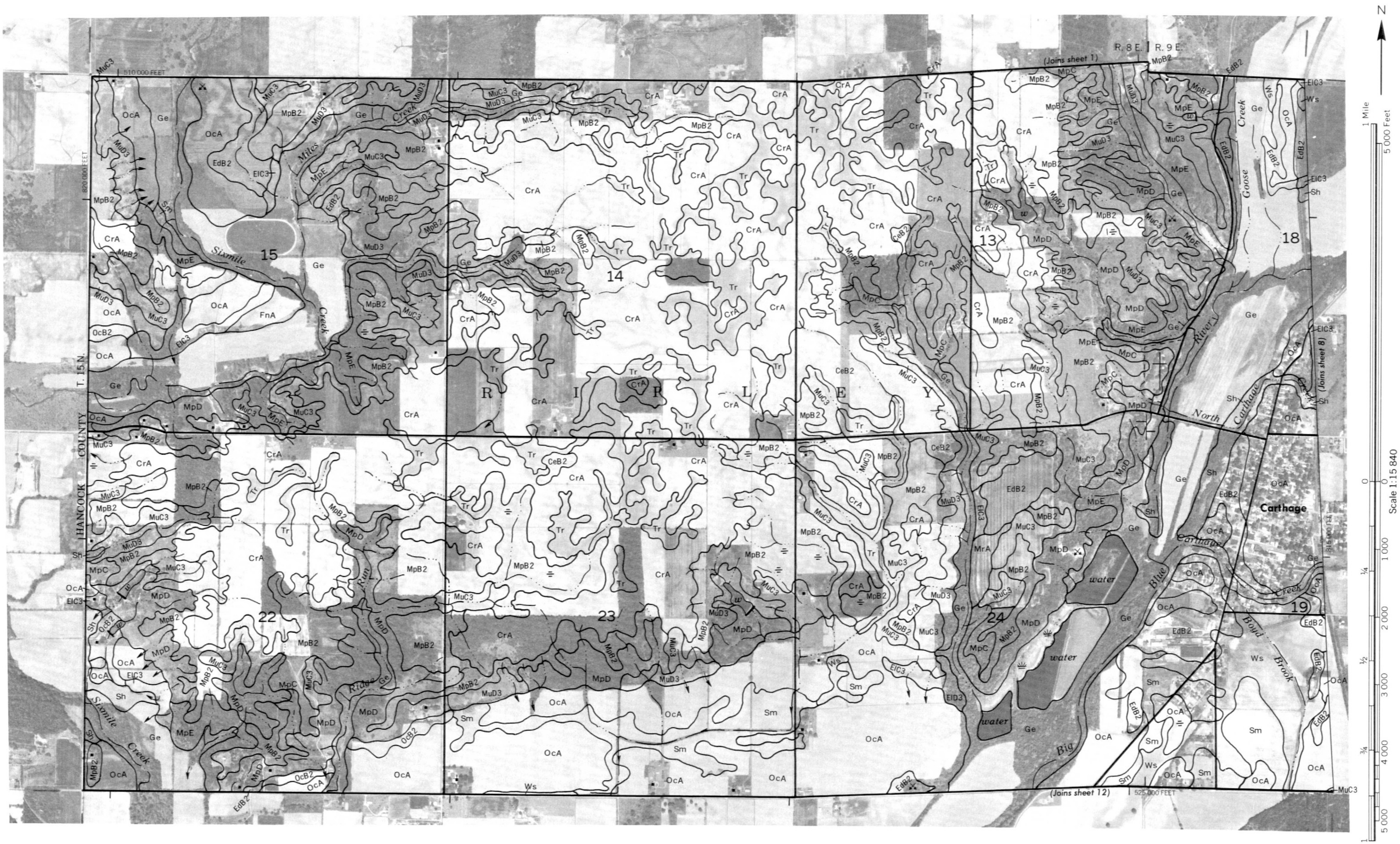


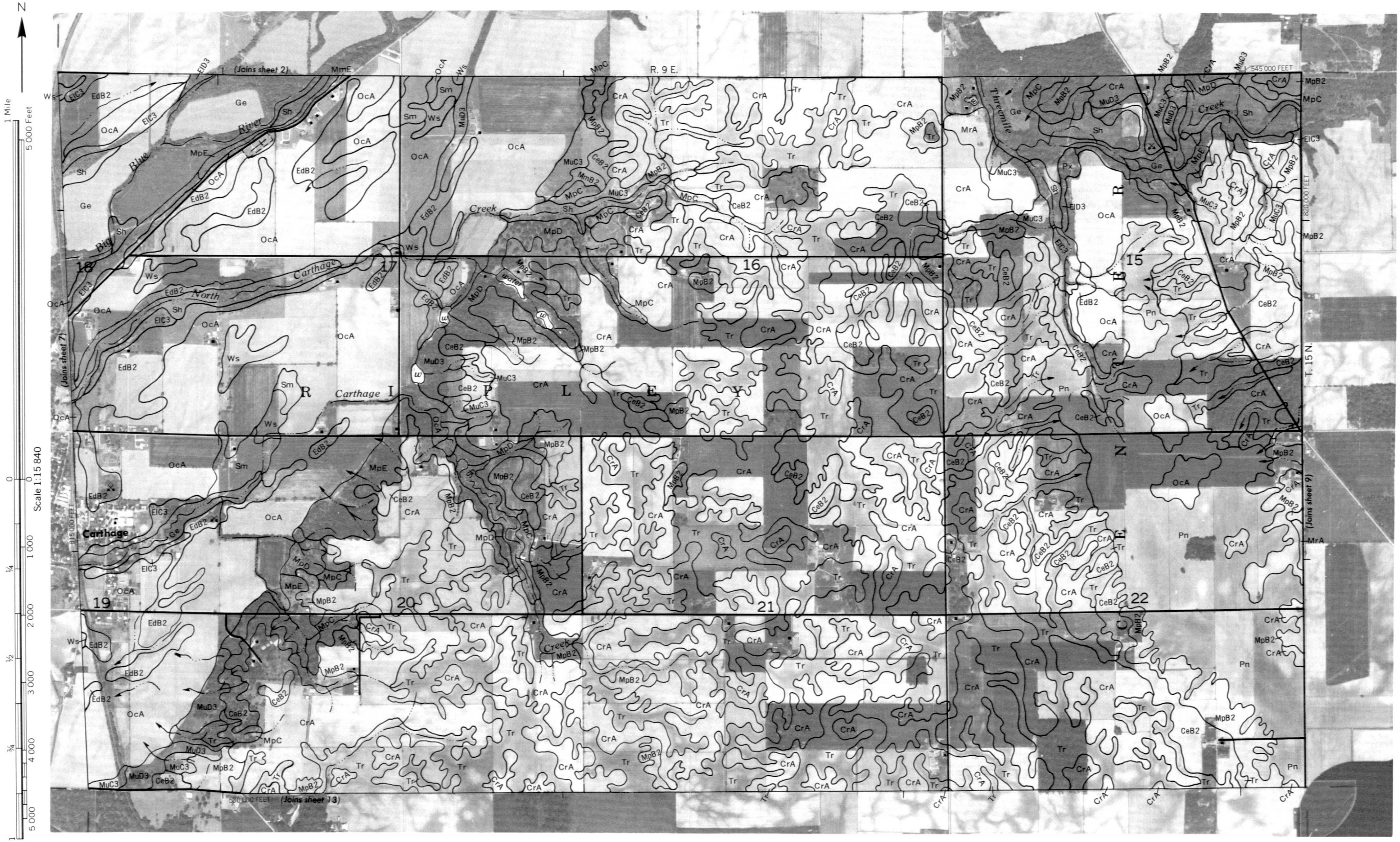
1000 AND 5000-FOOT GRID TICKS

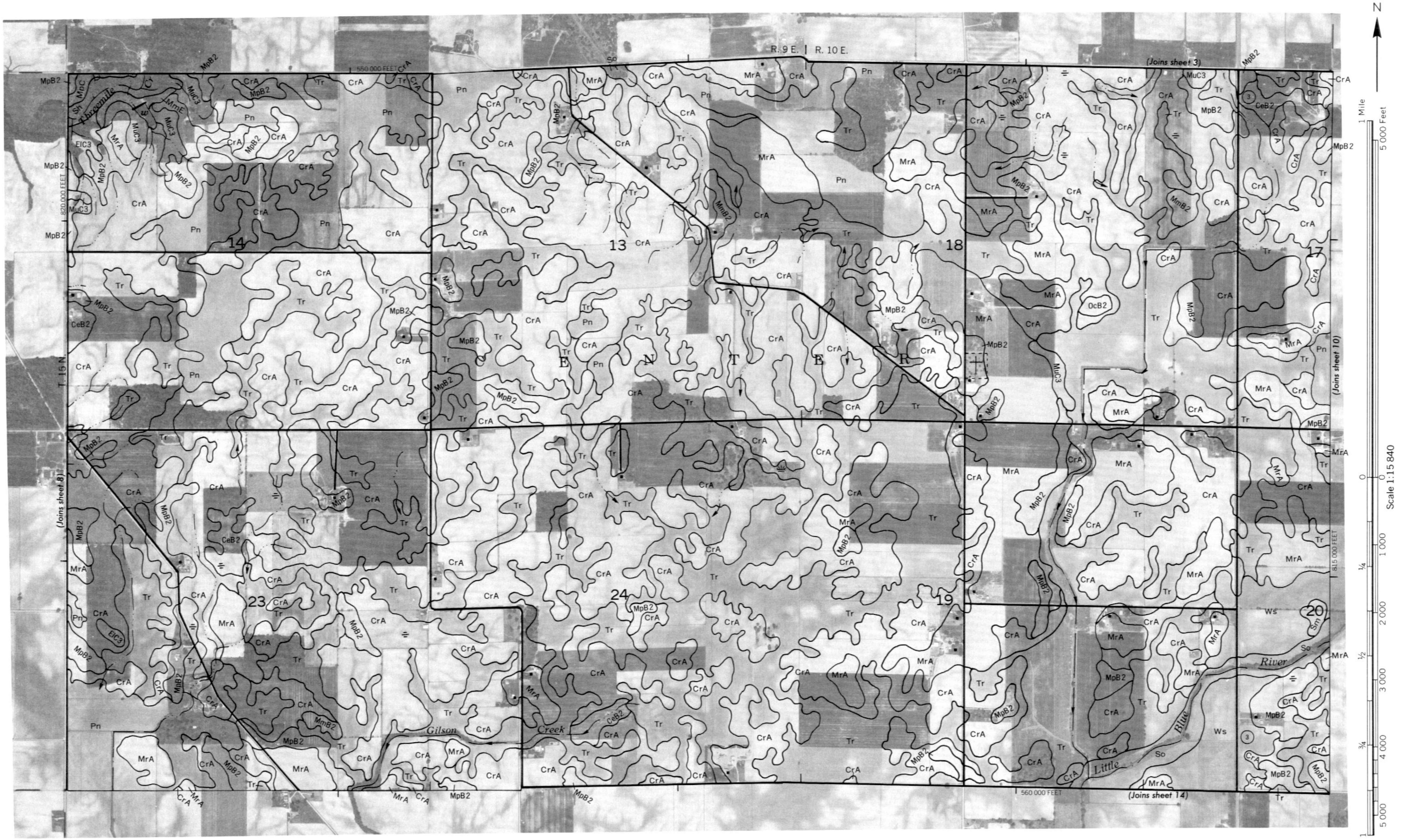
INSET C

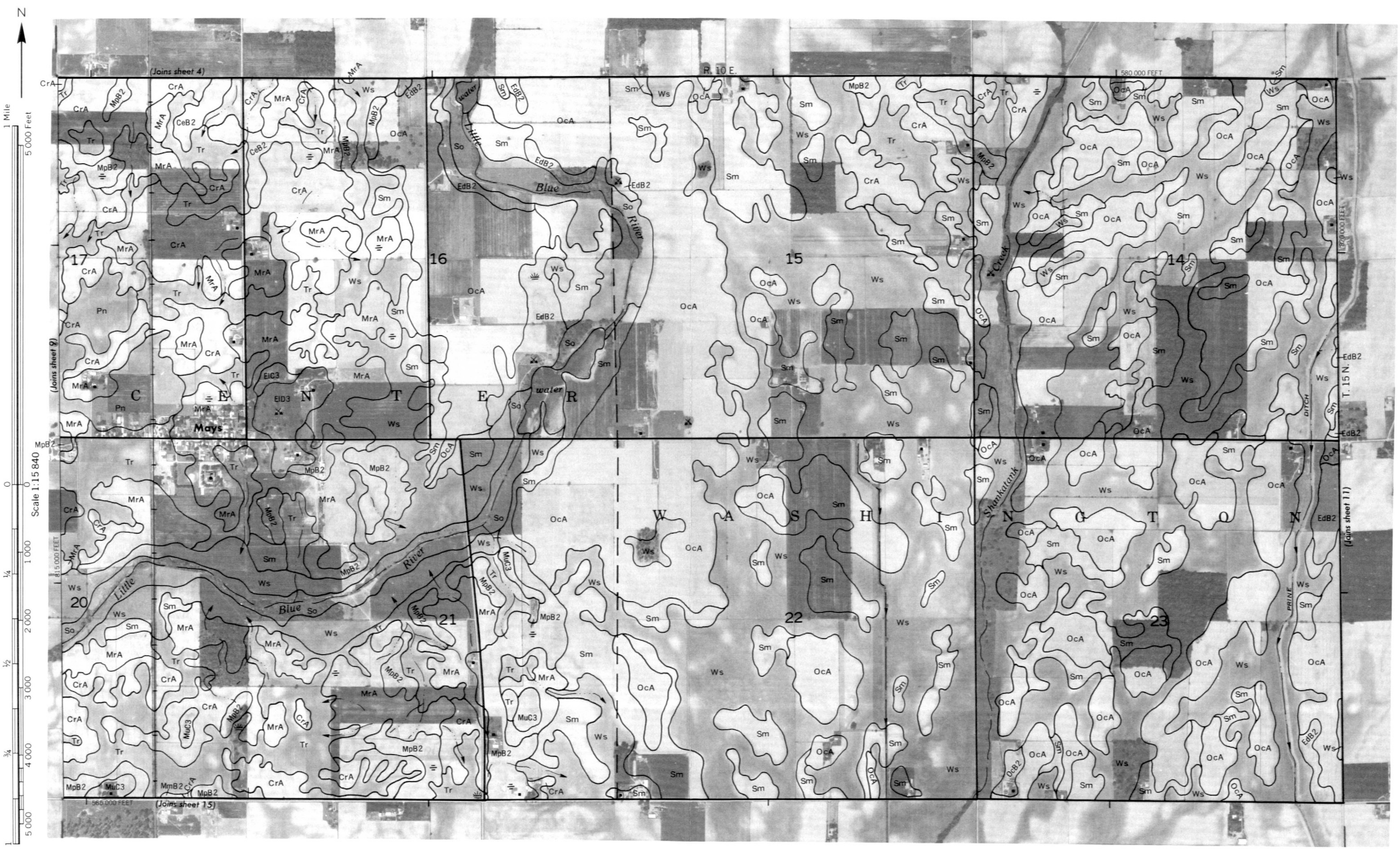


1000 AND 5000-FOOT GRID TICKS


N
R. 8 E.
R. 9 E.
(Joins sheet 1)
(Joins sheet 8)
(Joins sheet 12)
510 000 FEET
525 000 FEET
820 000 FEET
T. 15 N.
HANCOCK COUNTY
R I P L E Y
Carthage
Sixmile Creek
Miles Creek
Goose Creek
Big Blue River
North Carthage
Carthage Creek
Boyd Brook
Ridge Run
water
13
14
15
18
19
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840

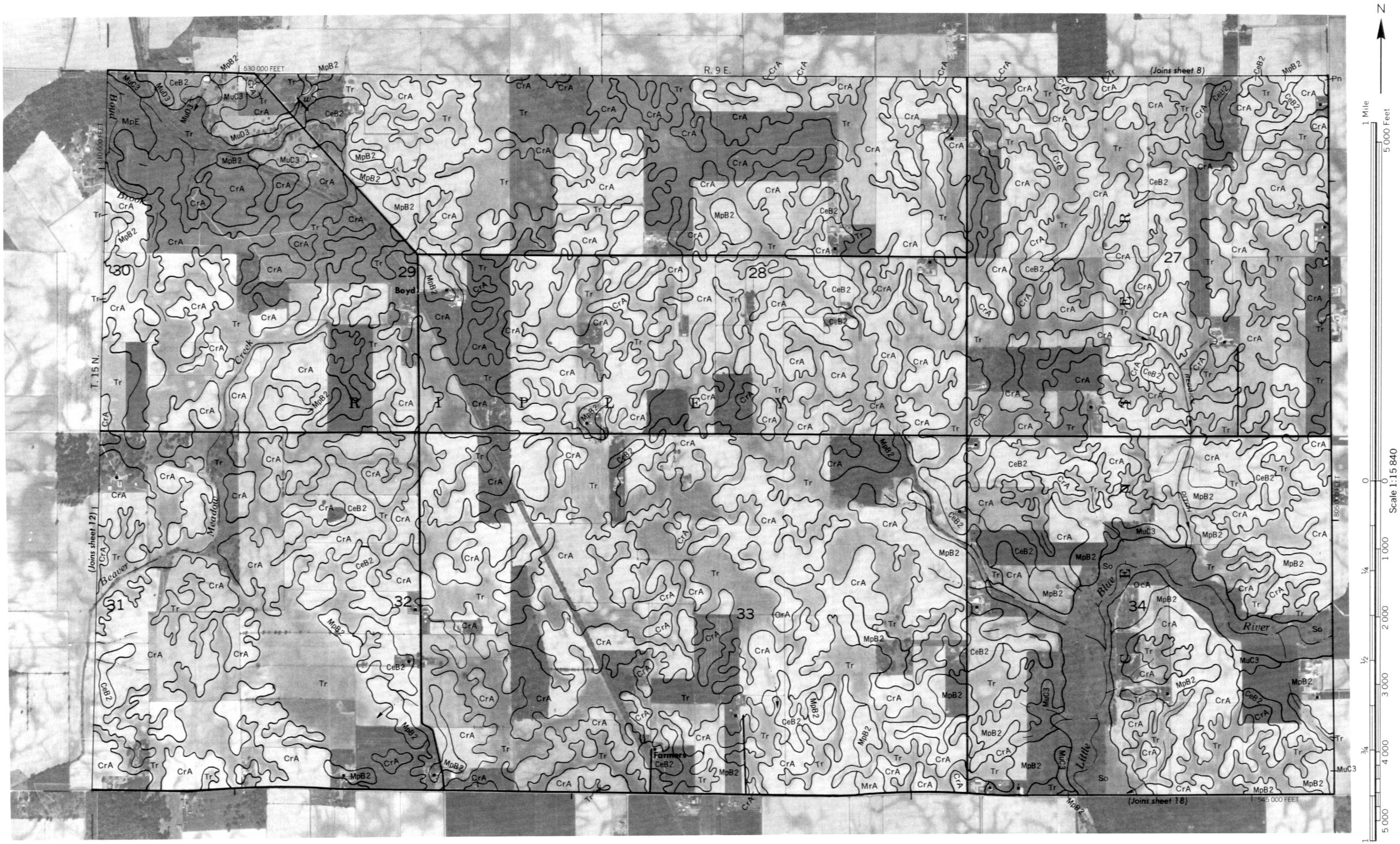

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
(Joins sheet 2)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
R. 9 E.
T. 15 N.
545 000 FEET
820 000 FEET
815 000 FEET
580 000 FEET
RIPLEY
RENNEC
Carthage
Big Blue River
North Carthage
Carthage
Creek
Threemile Creek
Creek
water
15
16
17
18
19
20
21
22
OcA
CrA
Tr
EdB2
ElC3
Ge
Sh
MpE
MpC
MpB2
MpD
MuC3
MuD3
CeB2
Ws
Sm
Pn
MrA
ElD3
MmE
MmB2
Px
w

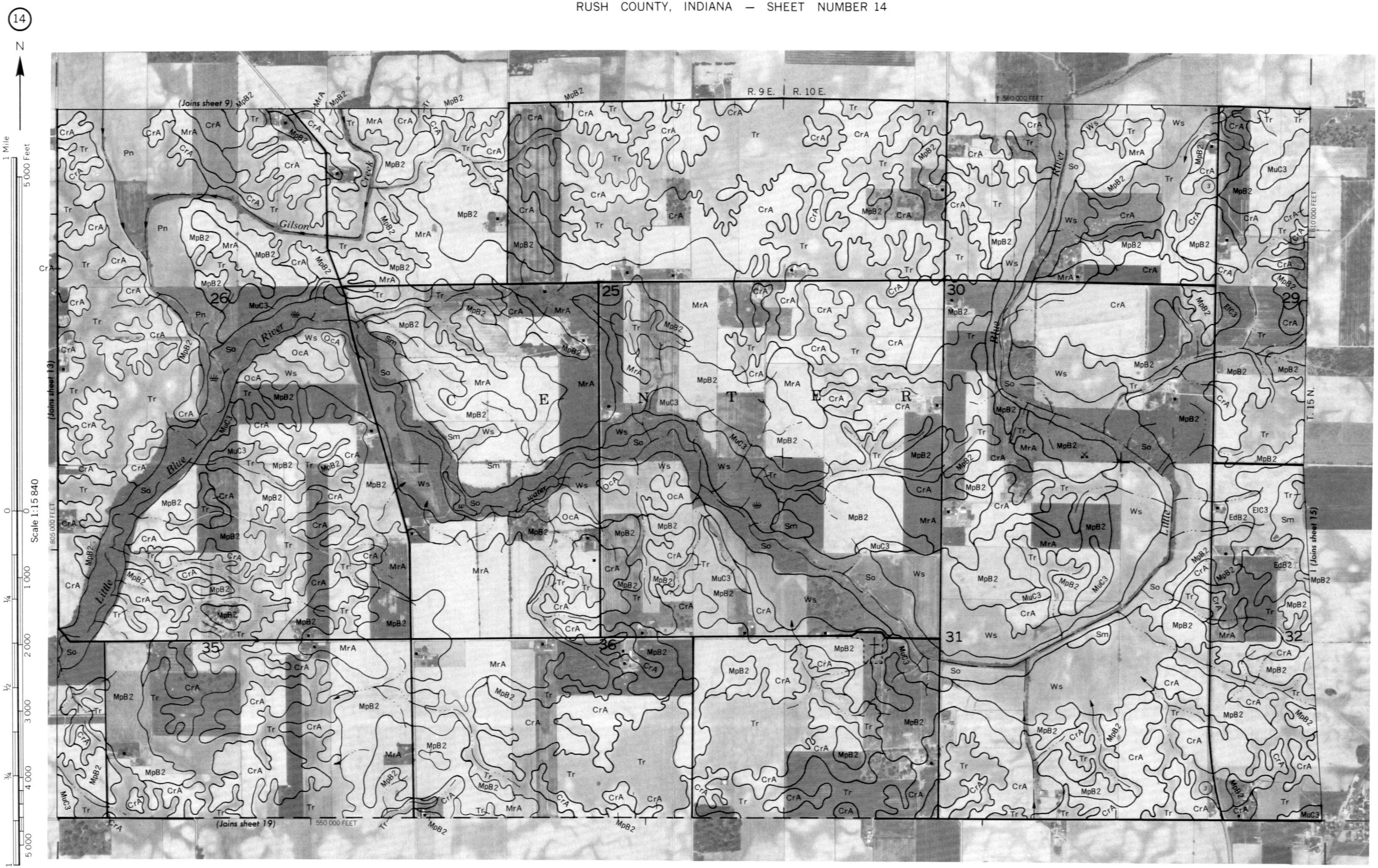

9
N
R. 9 E. | R. 10 E.
(Joins sheet 3)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 14)
T. 15 N.
550 000 FEET
560 000 FEET
820 000 FEET
815 000 FEET
CENTER
Threemile
Gilson Creek
Little Blue River
Scale 1:15 840
1 Mile
5 000 Feet
14
13
18
17
23
24
19
20

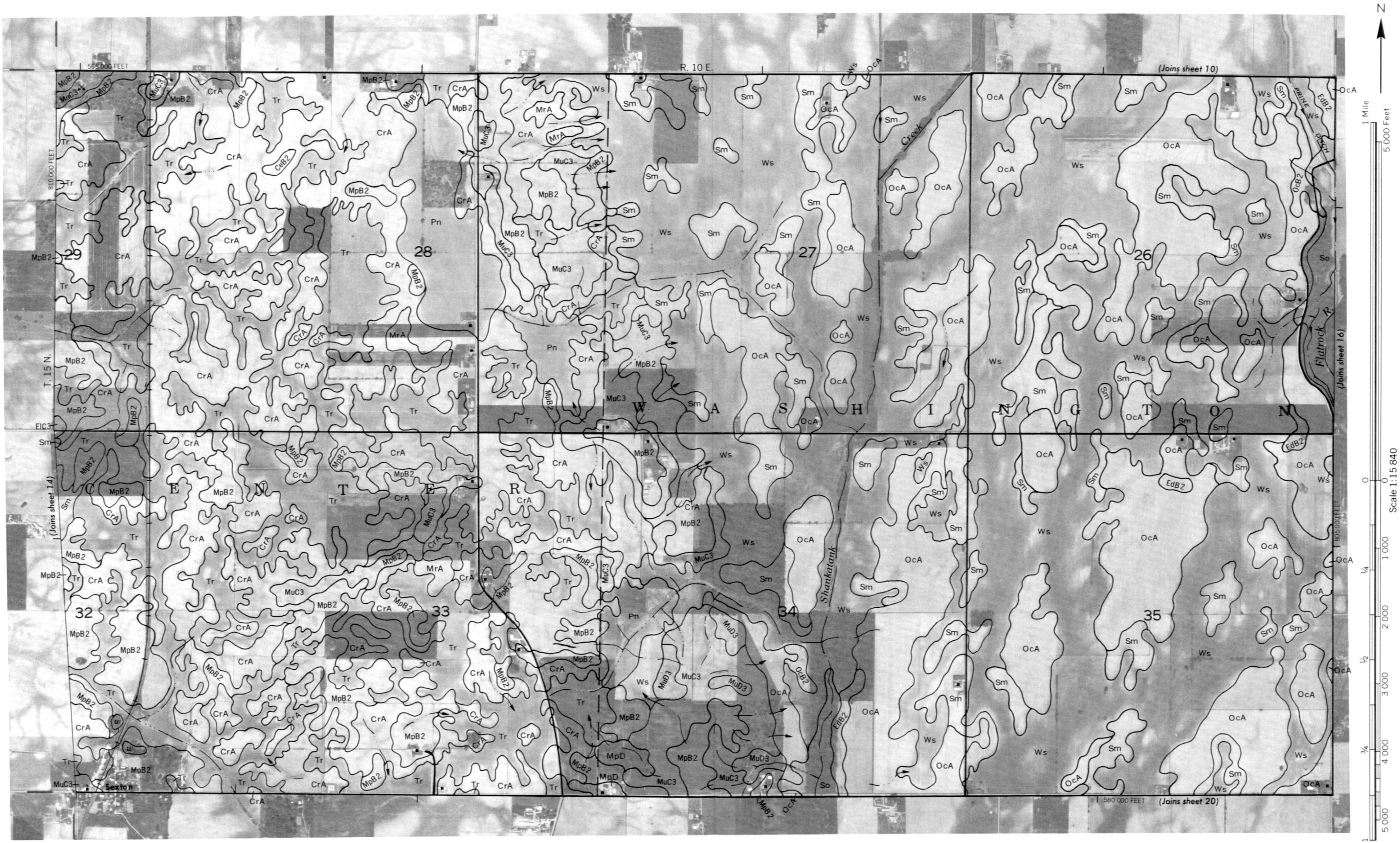

10
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 4)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 15)
R. 10 E.
T. 15 N.
580 000 FEET
565 000 FEET
815 000 FEET
Mays
Little Blue River
Shankatank Creek
PRINE DITCH
C E N T E R
W A S H I N G T O N
17
16
15
14
20
21
22
23

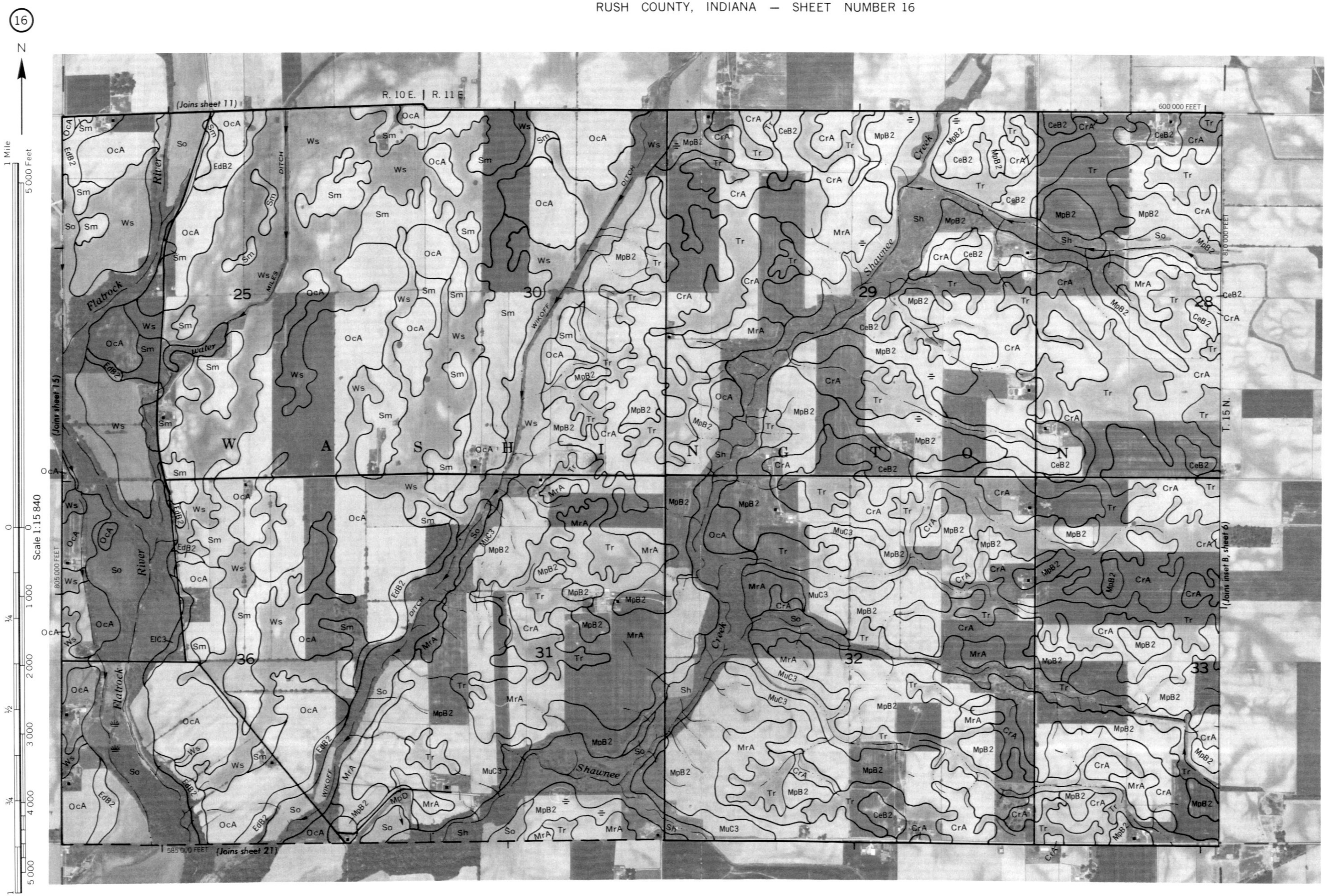

11
N
R. 10 E.
R. 11 E.
585 000 FEET
(Joins sheet 5)
820 000 FEET
T. 15 N.
(Joins sheet 10)
(Joins inset A, sheet 6)
(Joins sheet 16)
600 000 FEET
815 000 FEET
Raleigh
Flatrock
River
DITCH
PRINE
GLIDDEN
WIKOFF
MILES
ARM
Shawnee
Creek
North
Fork
W A S H I N G T O N
13
18
17
16
24
19
20
21
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

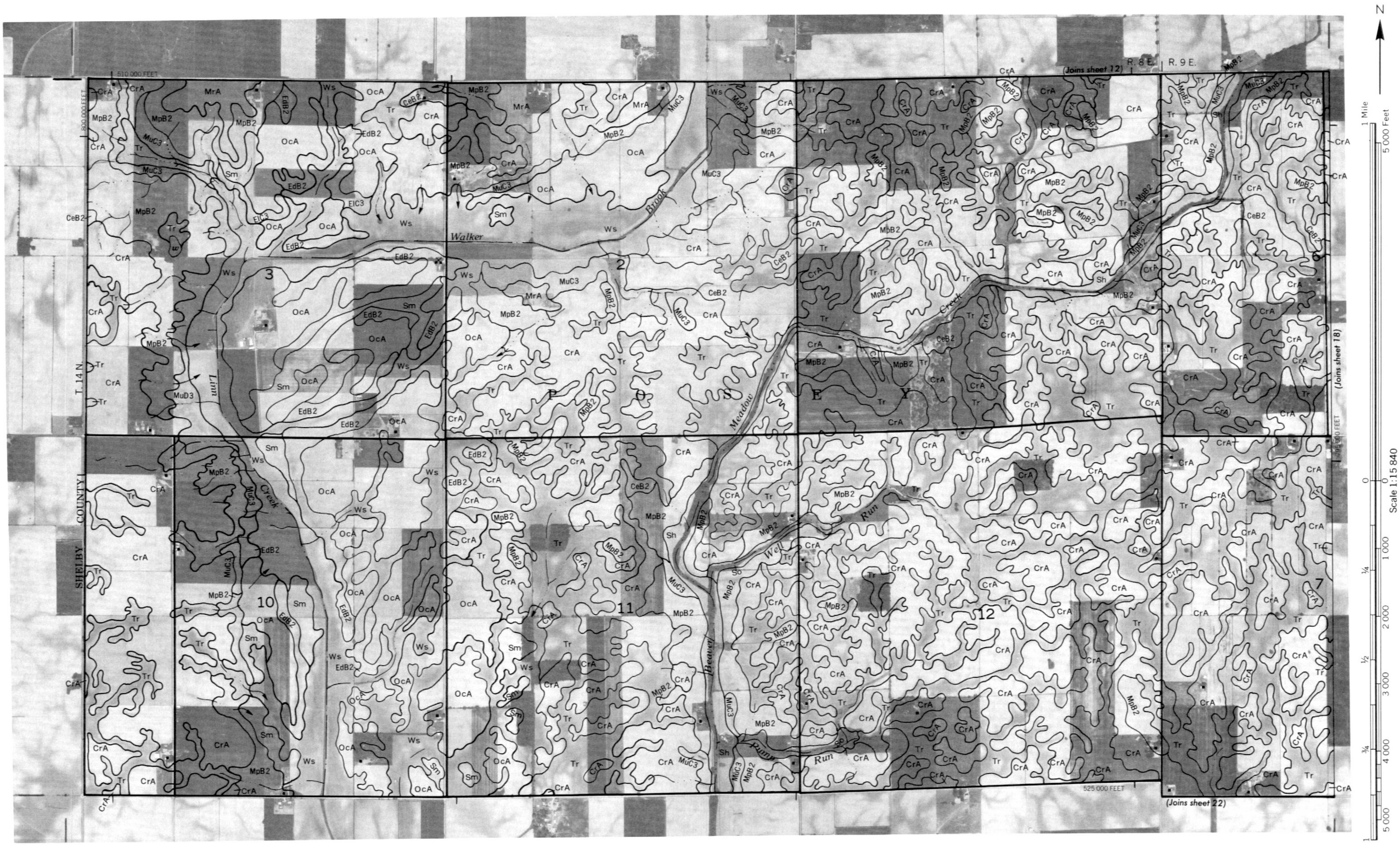

12
N
(Joins sheet 7)
(Joins sheet 17)
(Joins sheet 13)
HANCOCK COUNTY
R. 8 E.
R. 9 E.
T. 15 N.
525 000 FEET
810 000 FEET
510 000 FEET
Sixmile Creek
Ridge Run
Big Blue River
Little Blue River
RIPLEY
Circle
Beaver Meadow
water
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

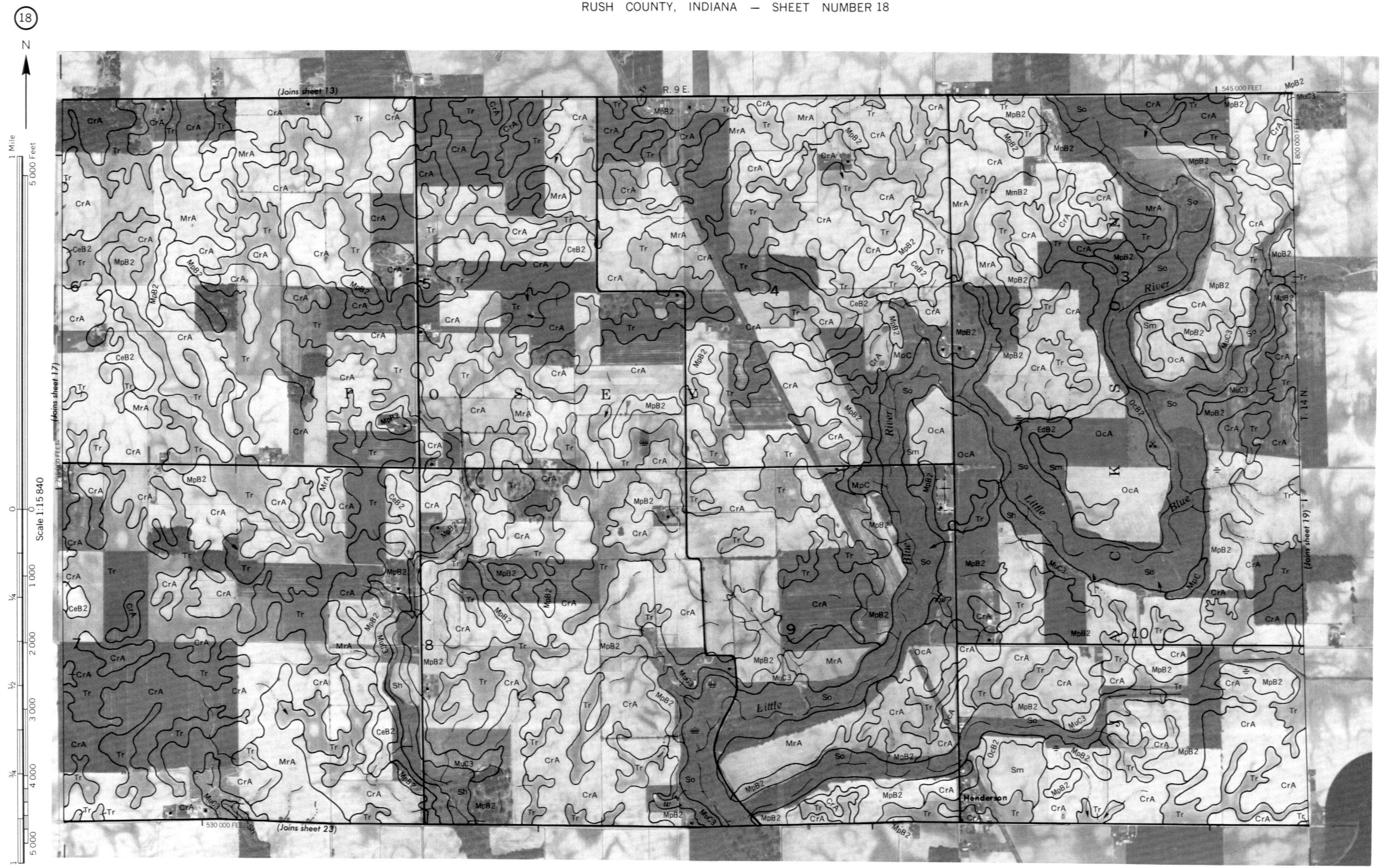

13
N
(Joins sheet 8)
(Joins sheet 12)
(Joins sheet 18)
R. 9 E.
T. 15 N.
530 000 FEET
810 000 FEET
805 000 FEET
545 000 FEET
RIPLEY
Boyd
Farmers
Boyd Brook
Beaver Meadow Creek
Little Blue River
1 Mile
5 000 Feet
Scale 1:15 840

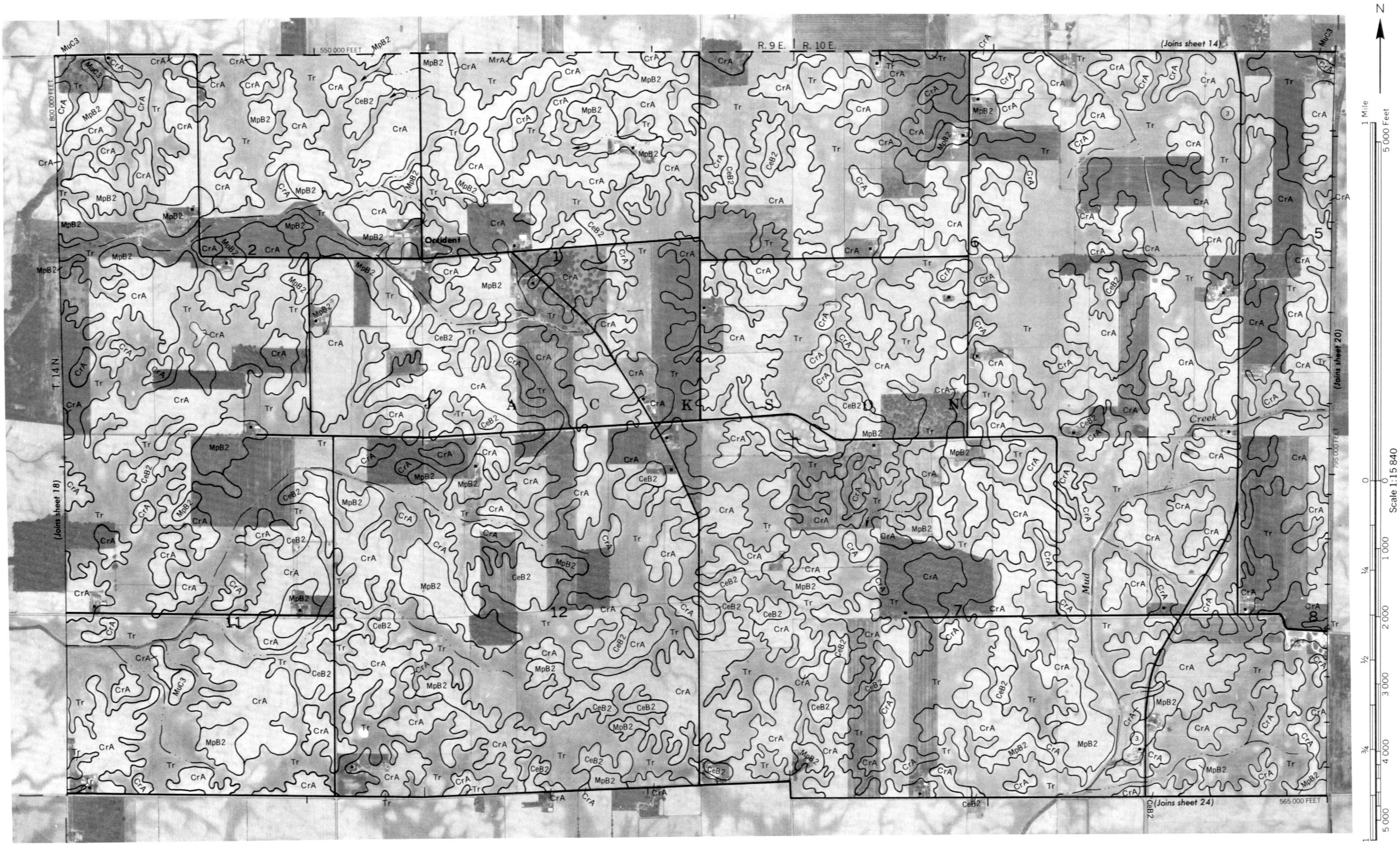

14
N
(Joins sheet 9)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 19)
R. 9 E. | R. 10 E.
T. 15 N.
560 000 FEET
550 000 FEET
810 000 FEET
805 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
Gilson Creek
Little Blue River
Blue River
Little
water
C E N T E R
25
26
29
30
31
32
35
36


15
N
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 20)
(Joins sheet 14)
R. 10 E.
T. 15 N.
WASHINGTON
CENTER
Sexton
Flatrock R.
Shankatank
Creek
585 000 FEET
810 000 FEET
580 000 FEET
805 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

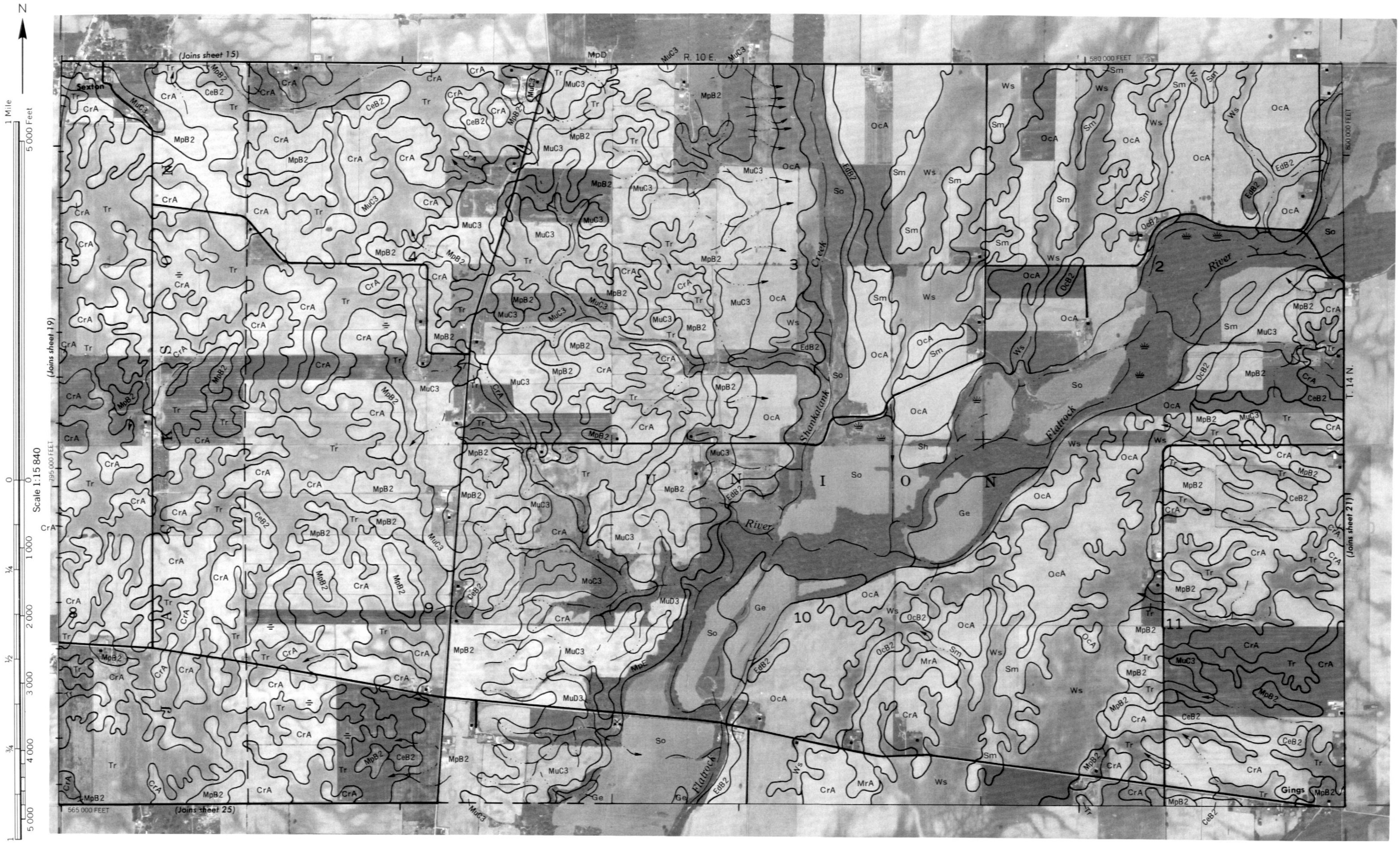

16
N
(Joins sheet 11)
R. 10 E. | R. 11 E.
600 000 FEET
810 000 FEET
805 000 FEET
585 000 FEET
(Joins sheet 15)
(Joins sheet 21)
(Joins inset B, sheet 6)
T. 15 N.
W A S H I N G T O N
Flatrock River
Shawnee Creek
Wikoff Ditch
Miles Ditch
25
30
29
28
36
31
32
33
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
1/4
1/2
3/4
Scale 1:15 840

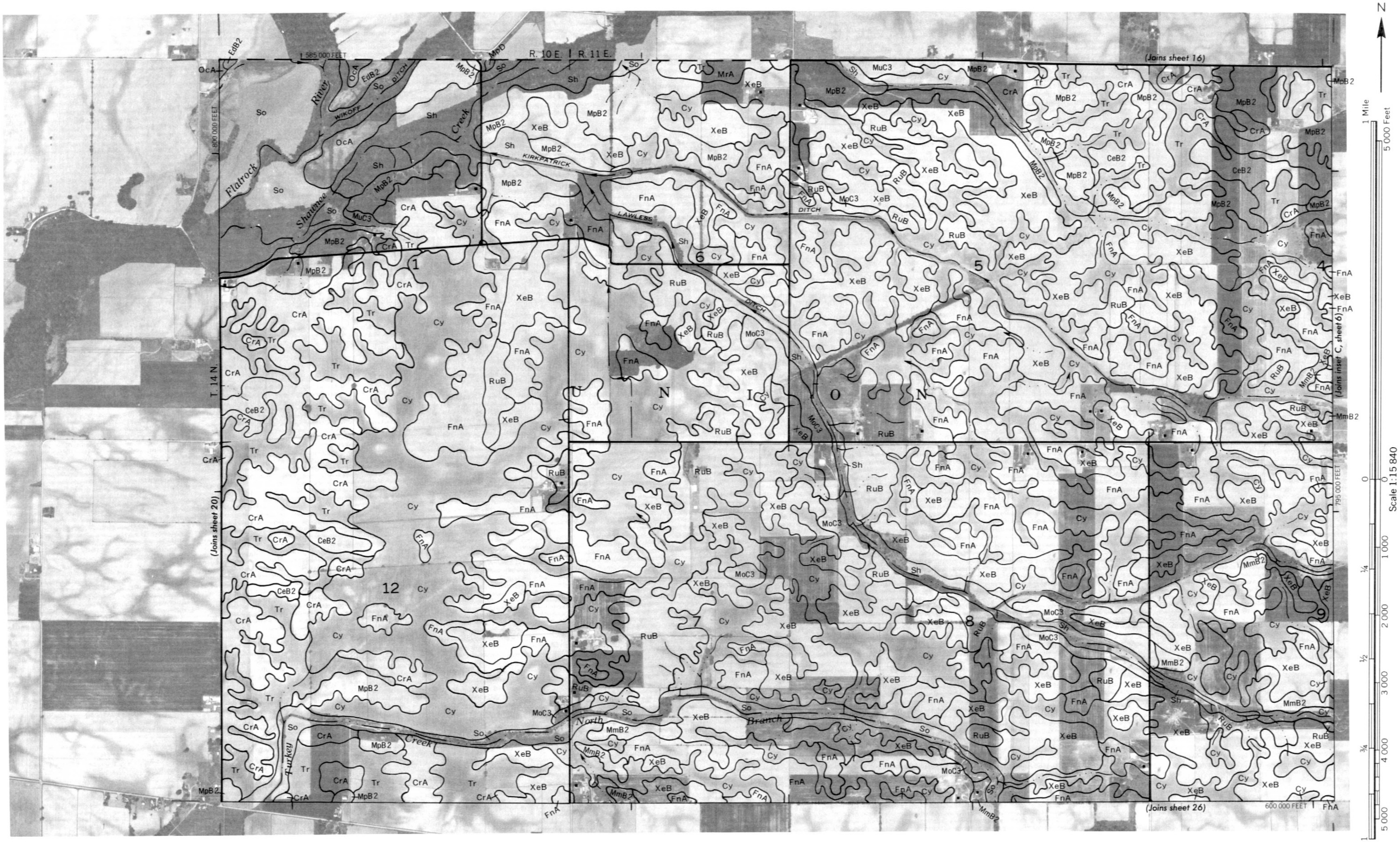

N
(Joins sheet 12)
R. 8 E.
R. 9 E.
(Joins sheet 18)
(Joins sheet 22)
T. 14 N.
SHELBY COUNTY
P O S E Y
Walker Brook
Linn Creek
Meadow Creek
Beaver
Well Run
Duck Run
510 000 FEET
800 000 FEET
525 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840

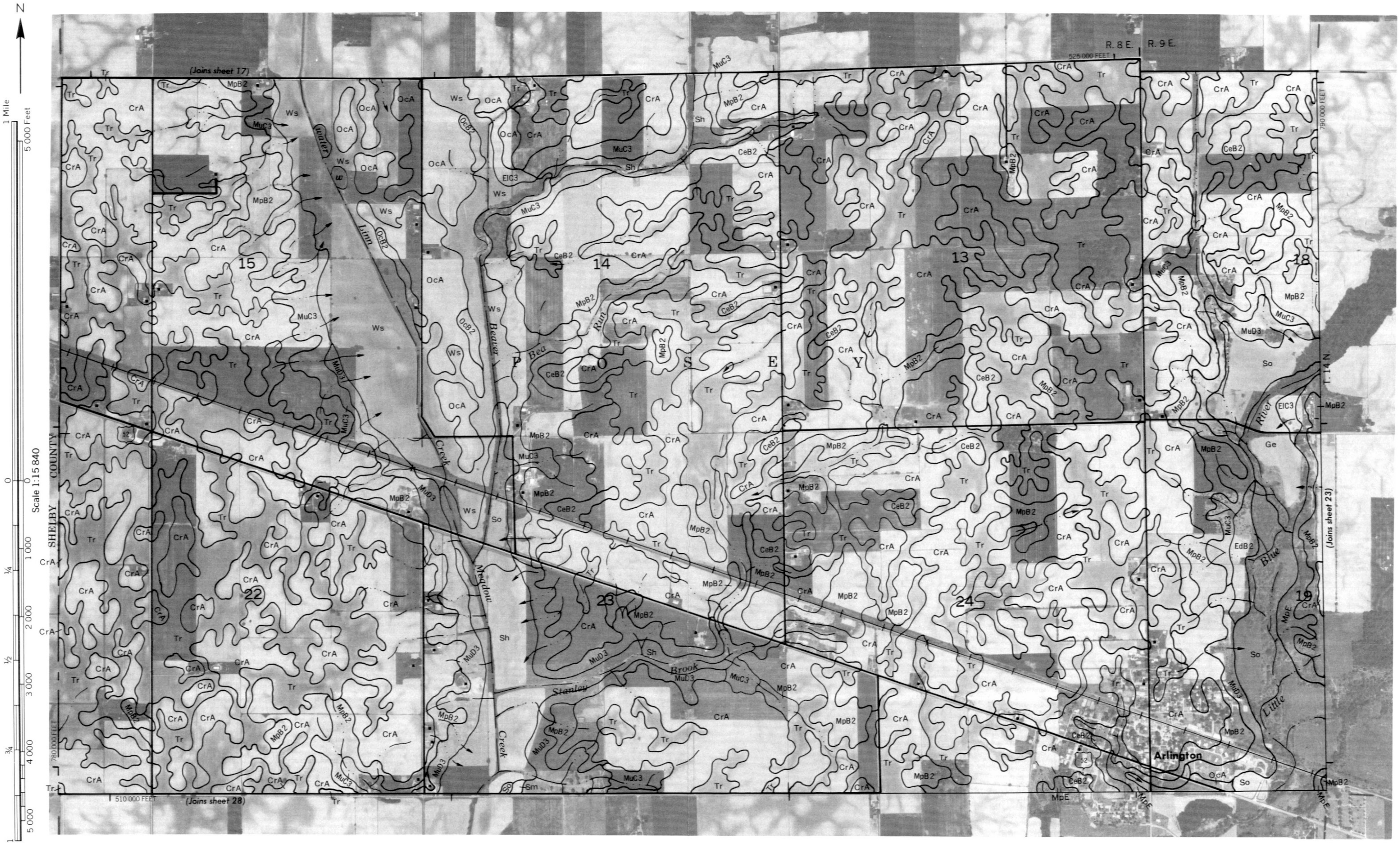

18
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 13)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 23)
R. 9 E.
T. 14 N.
545 000 FEET
800 000 FEET
530 000 FEET
Henderson
Little Blue River
P O S E Y
N O S K C

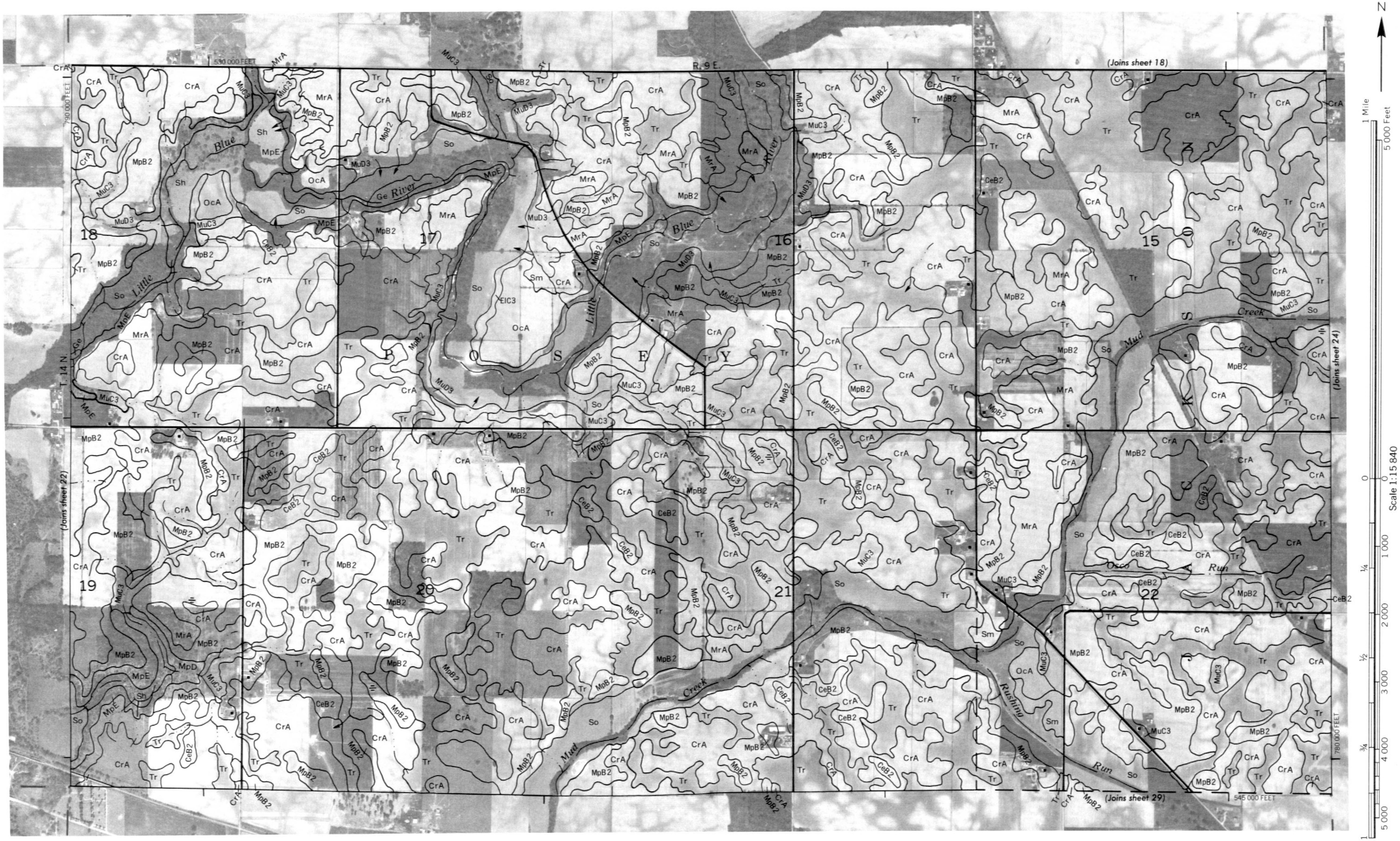

N
(Joins sheet 14)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 24)
R. 9 E.
R. 10 E.
T. 14 N.
550 000 FEET
565 000 FEET
800 000 FEET
795 000 FEET
Occident
JACKSON
Mud
Creek
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

RUSH COUNTY, INDIANA — SHEET NUMBER 20

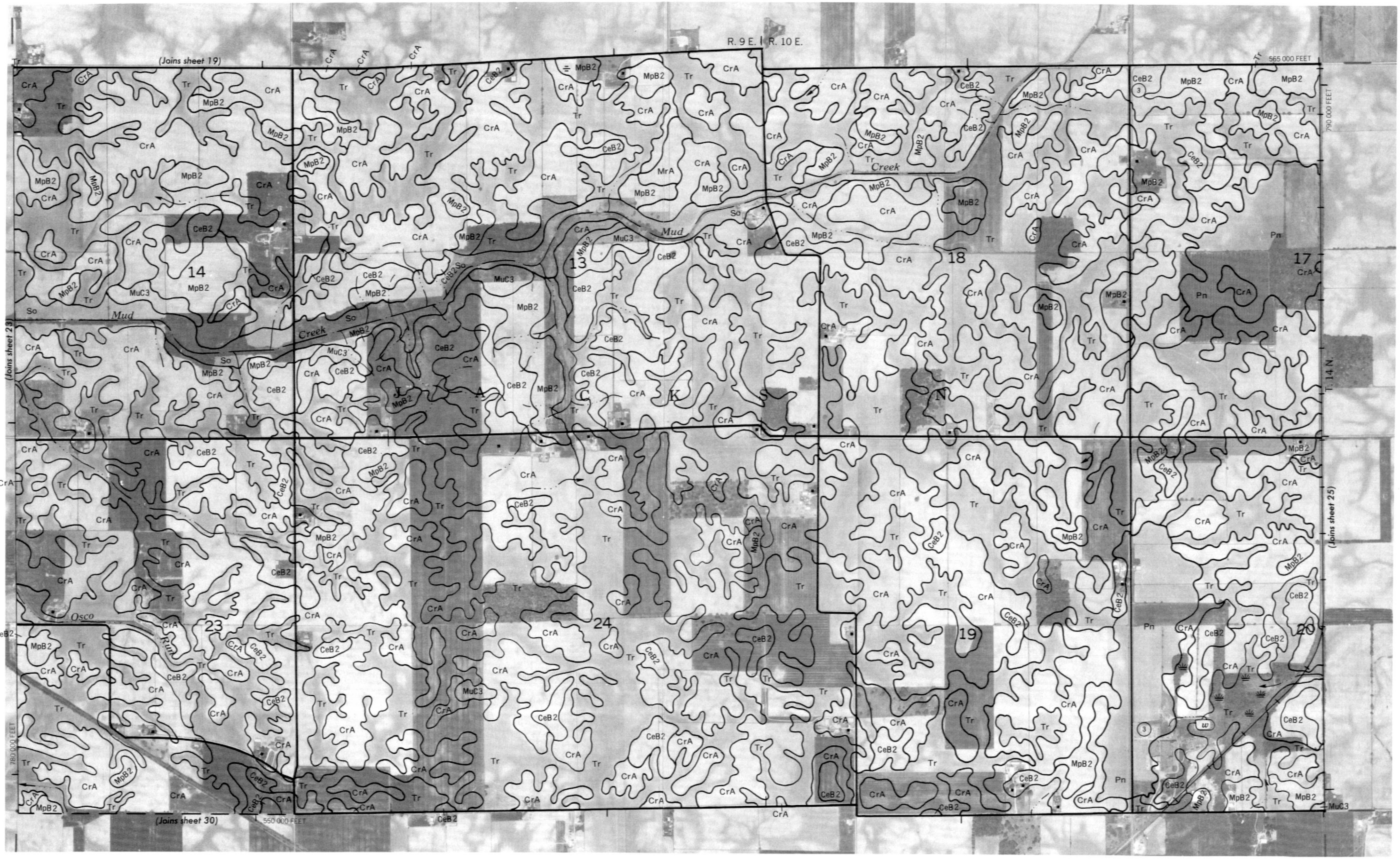


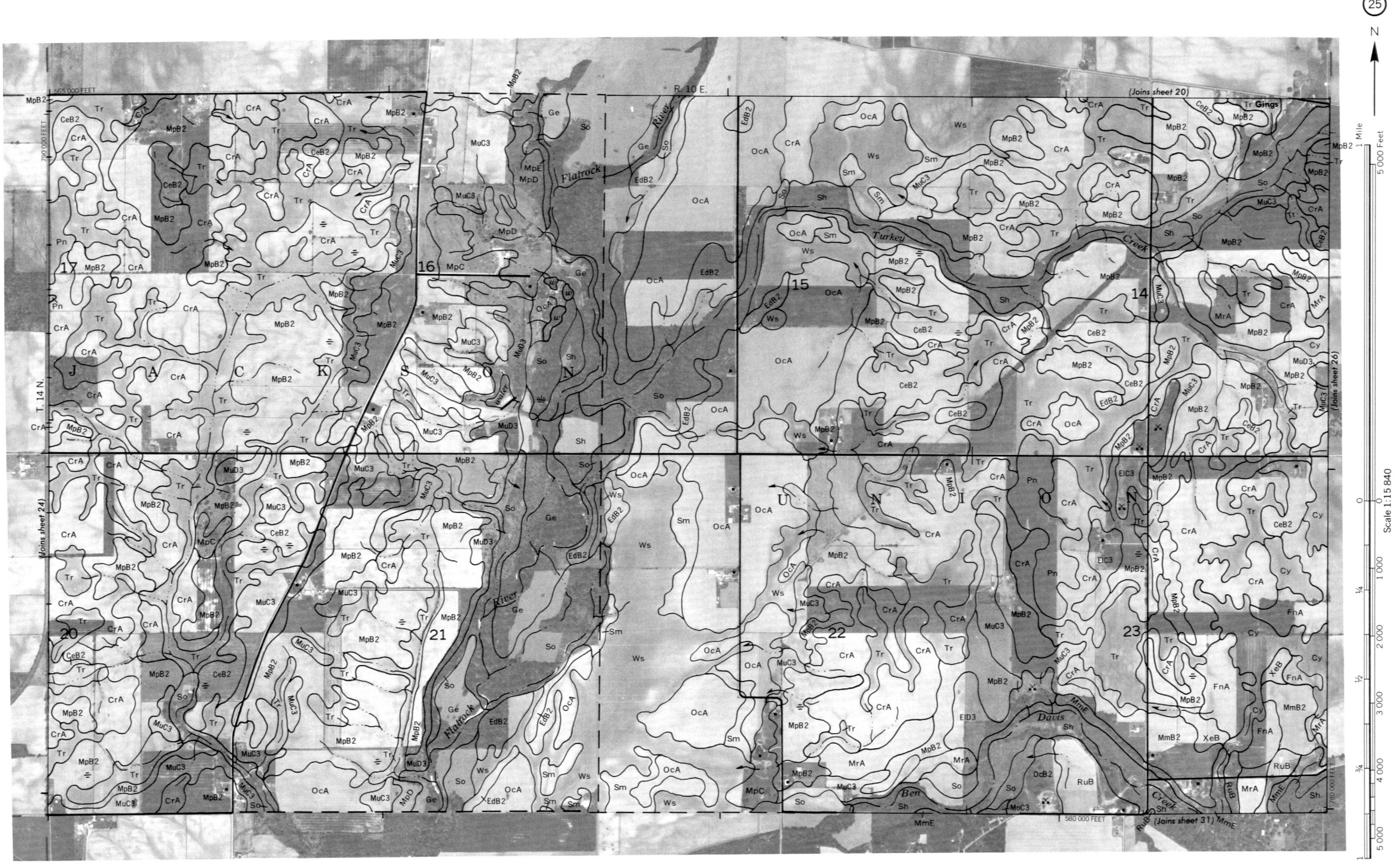

N
(Joins sheet 16)
(Joins sheet 20)
(Joins sheet 26)
(Joins inset C, sheet 6)
R. 10 E.
R. 11 E.
T. 14 N.
585 000 FEET
800 000 FEET
795 000 FEET
600 000 FEET
Flatrock
River
Shankoe
Creek
WIKOFF DITCH
KIRKPATRICK
LAWLESS
DITCH
North Branch
Creek
Turkey
U N I O N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
2
3
4
5
6
7
8
9
12

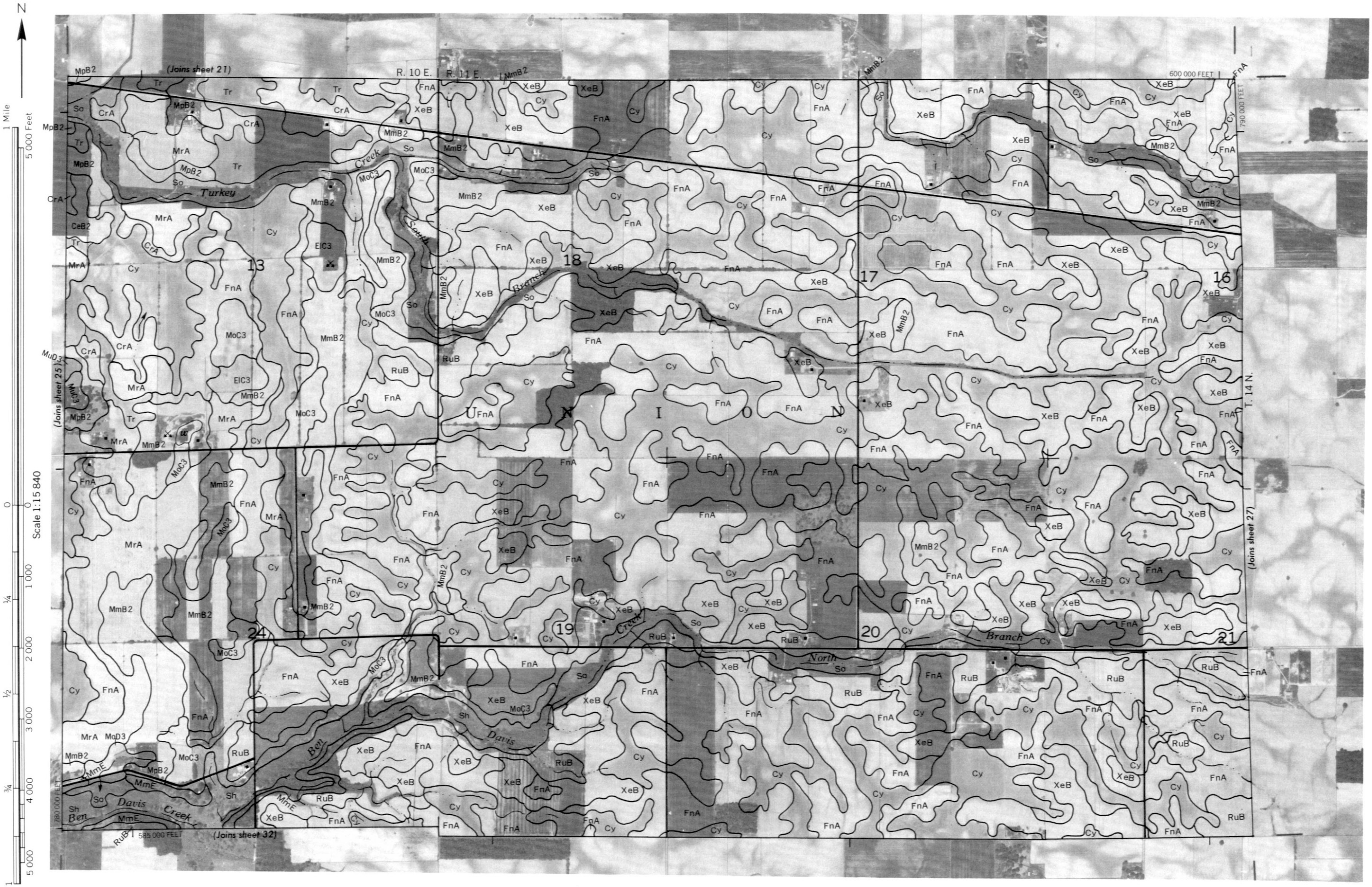

22
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 17)
(Joins sheet 23)
(Joins sheet 28)
SHELBY COUNTY
R. 8 E.
R. 9 E.
T. 14 N.
525 000 FEET
790 000 FEET
780 000 FEET
510 000 FEET
Arlington
Flatrock?
Beaver Creek
Meadow Creek
Stanley Brook
Little Blue River
Linn
P O S E Y
15
14
13
18
22
23
24
19

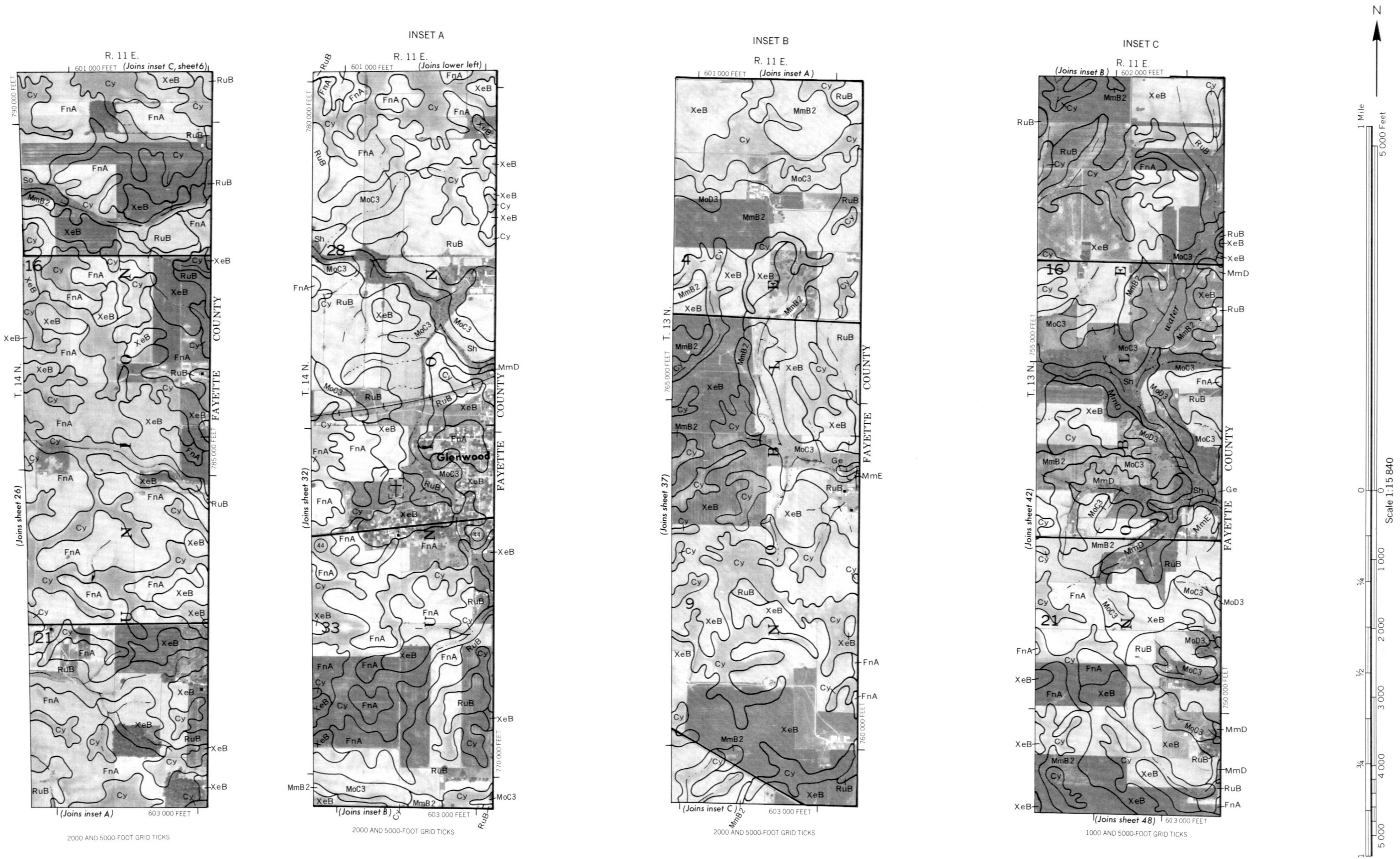

23
N
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 22)
R. 9 E.
T. 14 N.
530 000 FEET
545 000 FEET
790 000 FEET
780 000 FEET
Little Blue River
Mud Creek
Osco Run
Rushing Run
P O S E Y
R U S H
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

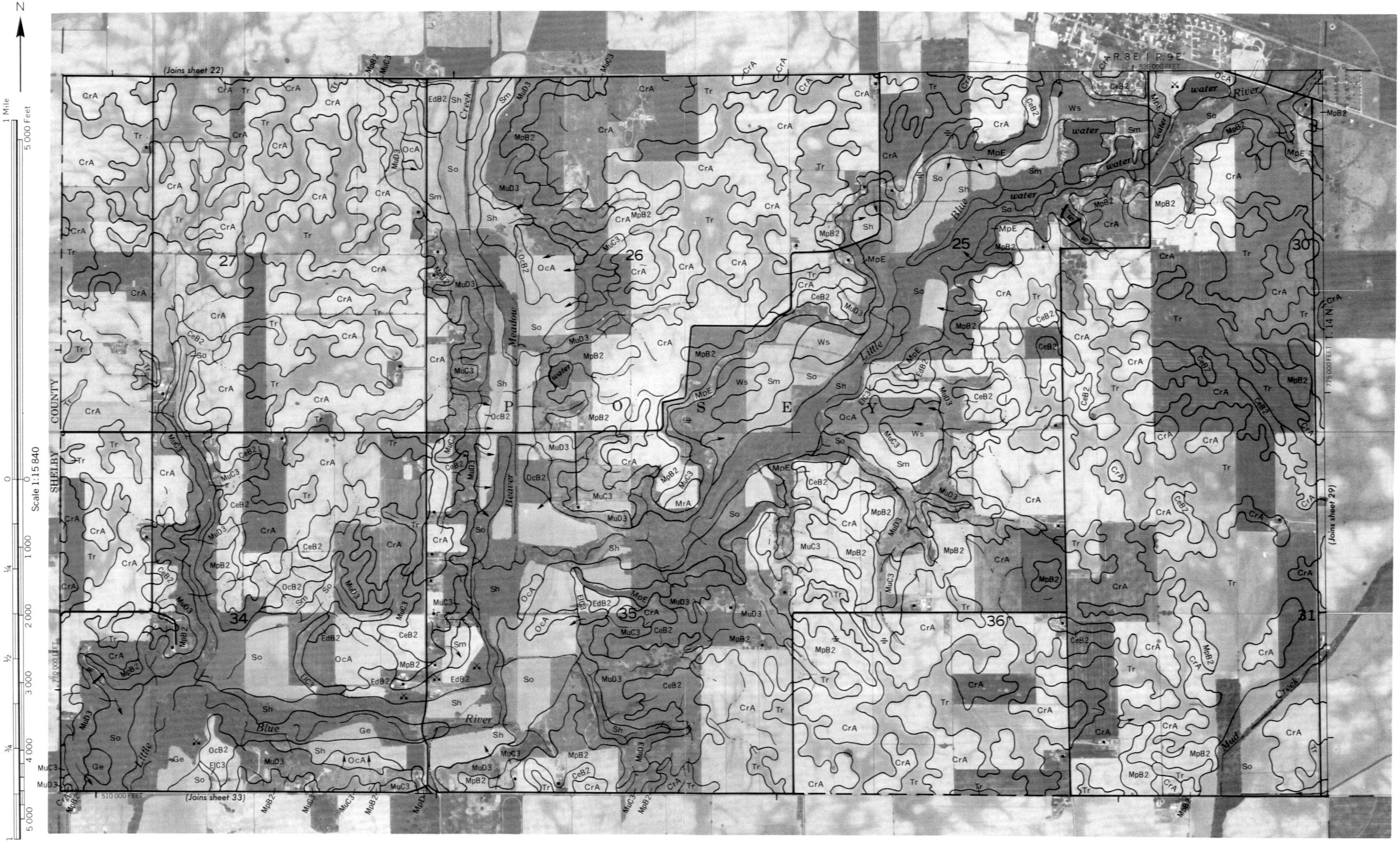
24


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 19)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 30)
R. 9 E. | R. 10 E.
T. 14 N.
565 000 FEET
790 000 FEET
780 000 FEET
550 000 FEET
Mud Creek
Osco Run
JACKSON
14
13
18
17
23
24
19
20

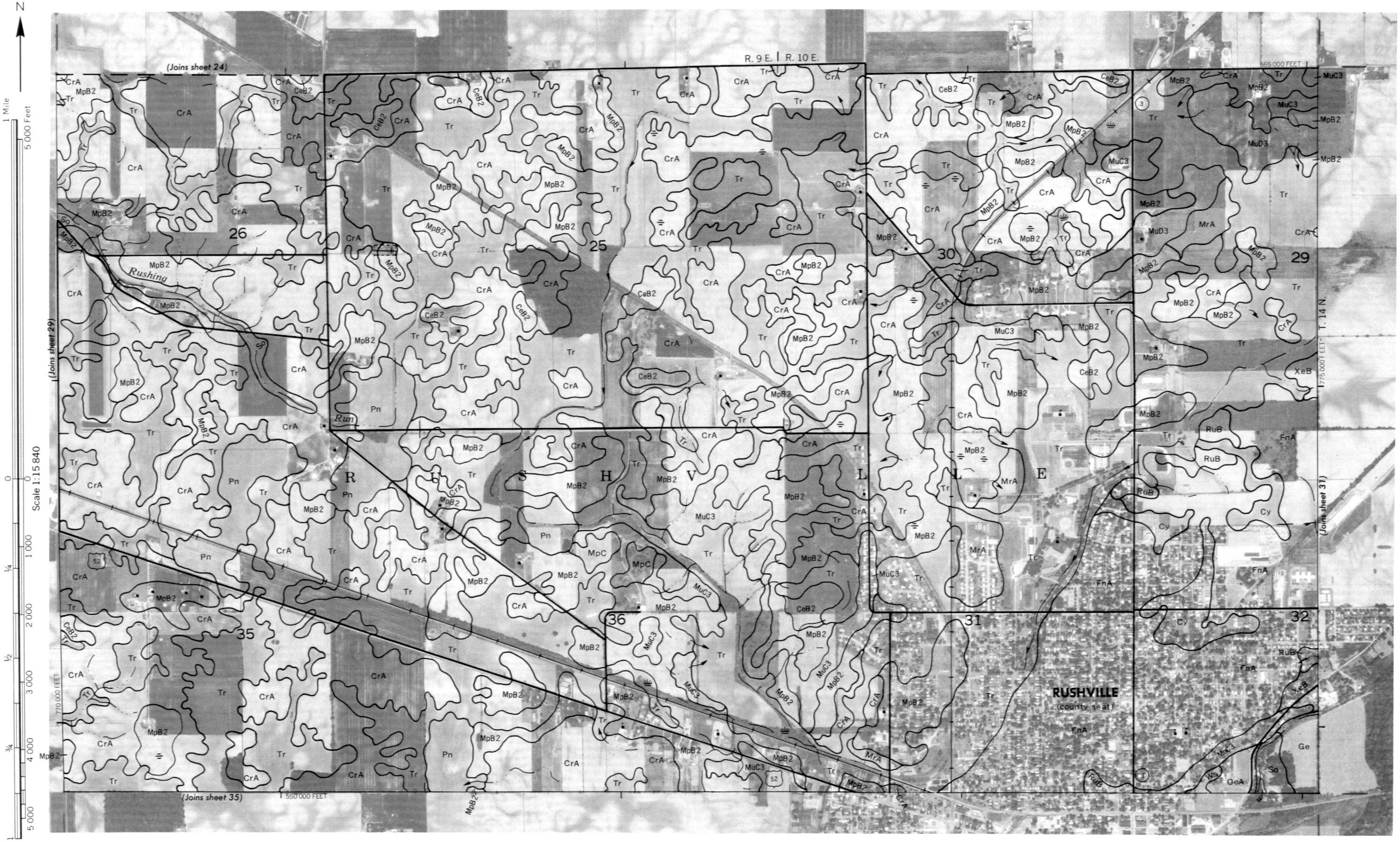

25
N
(Joins sheet 20)
(Joins sheet 26)
(Joins sheet 31)
(Joins sheet 24)
R. 10 E.
T. 14 N.
565 000 FEET
790 000 FEET
580 000 FEET
780 000 FEET
JACKSON
UNION
Flatrock River
Turkey Creek
Ben Davis Creek
Gings
1 Mile
5 000 Feet
Scale 1:15 840

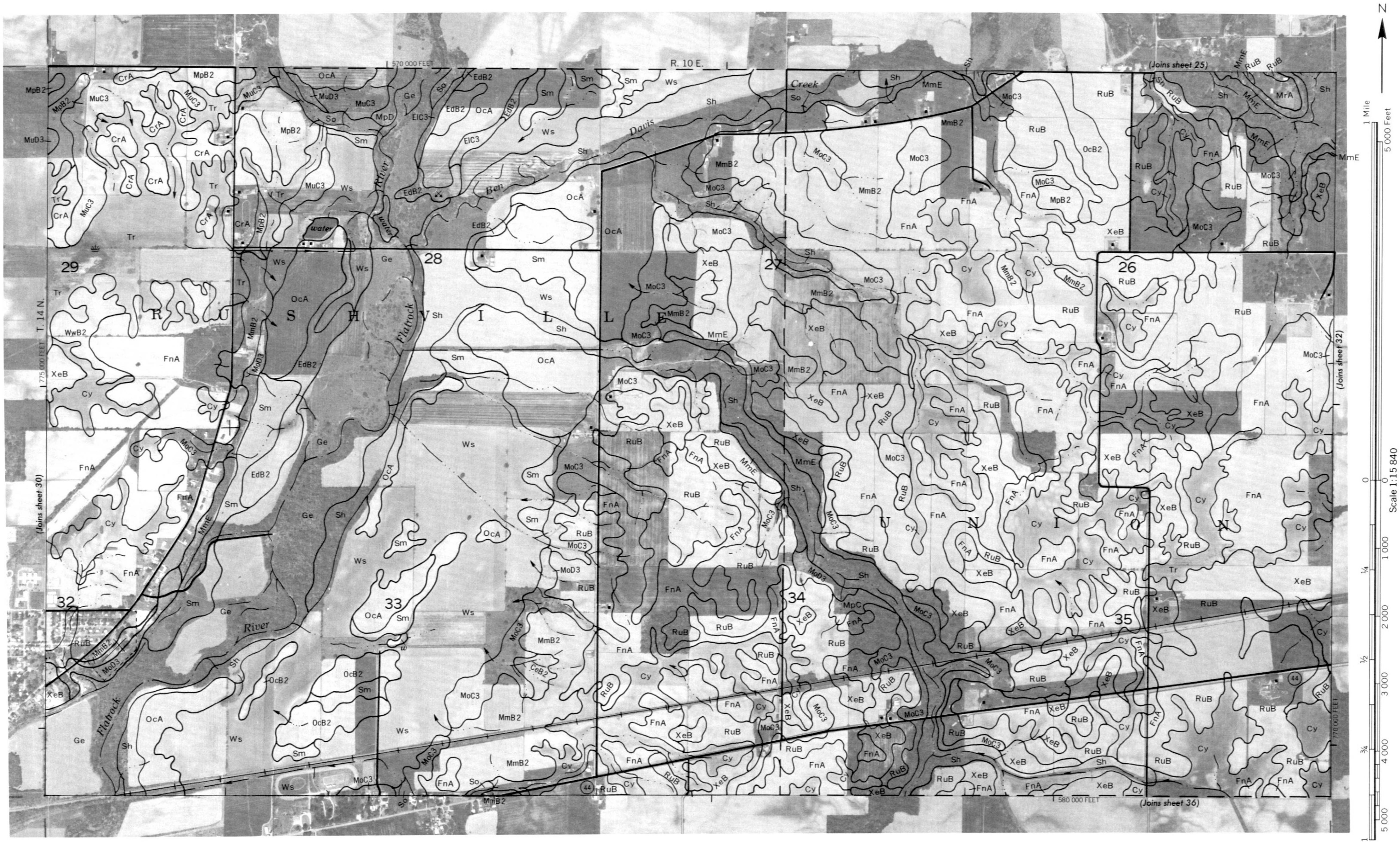

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 21)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 32)
R. 10 E.
R. 11 E.
T. 14 N.
600 000 FEET
790 000 FEET
585 000 FEET
780 000 FEET
Turkey
Creek
South
Branch
North
Branch
Ben
Davis
Creek
U N I O N
13
16
17
18
19
20
21
24


27
N
INSET A
INSET B
INSET C
R. 11 E.
601 000 FEET
(Joins inset C, sheet6)
(Joins lower left)
(Joins inset A)
(Joins inset B)
602 000 FEET
T. 14 N.
T. 13 N.
FAYETTE COUNTY
Glenwood
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 37)
(Joins sheet 42)
(Joins inset A)
(Joins inset B)
(Joins inset C)
(Joins sheet 48)
603 000 FEET
790 000 FEET
785 000 FEET
780 000 FEET
770 000 FEET
765 000 FEET
760 000 FEET
755 000 FEET
750 000 FEET
2000 AND 5000-FOOT GRID TICKS
1000 AND 5000-FOOT GRID TICKS
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

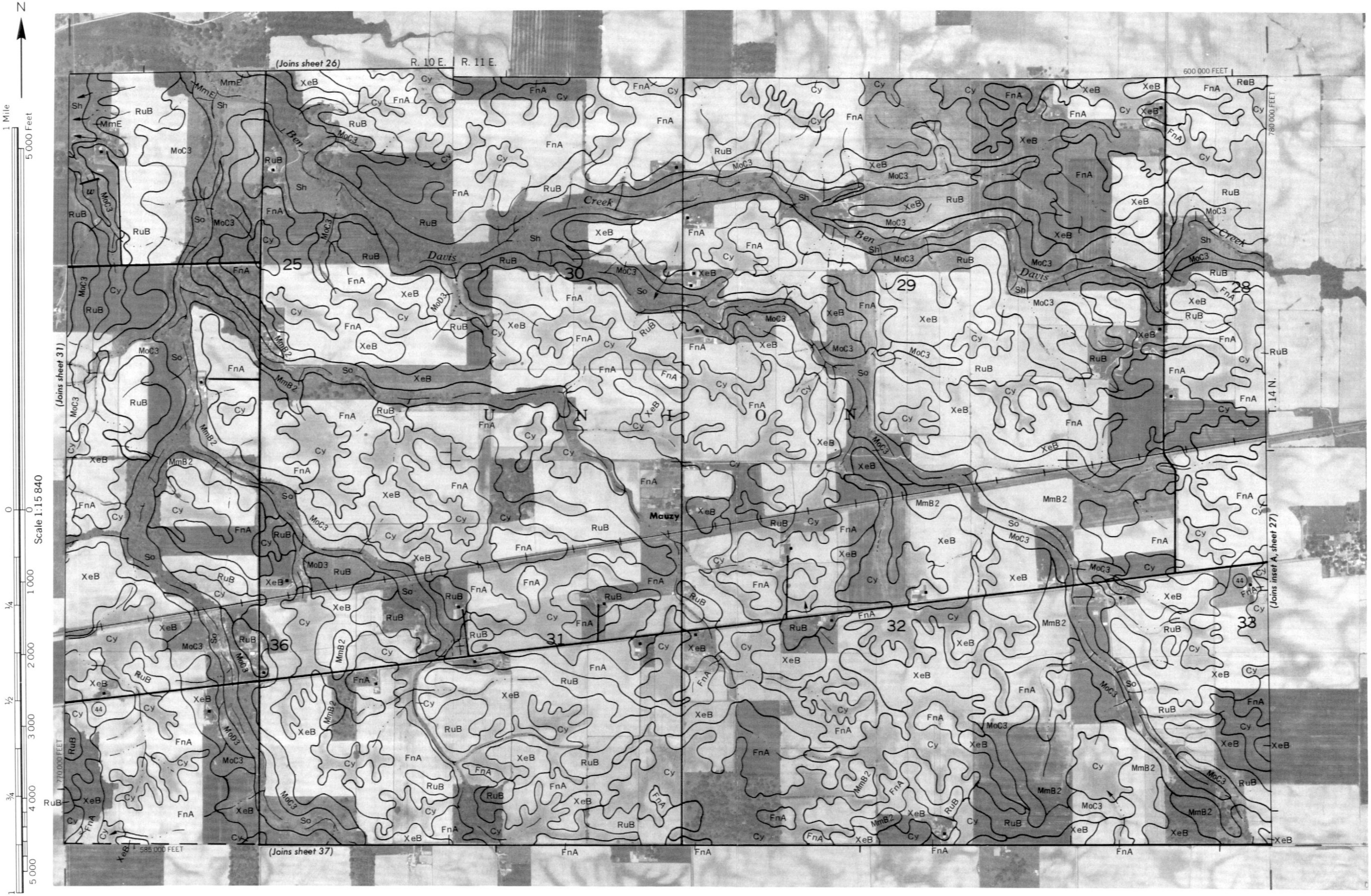

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 22)
(Joins sheet 33)
(Joins sheet 29)
SHELBY COUNTY
R. 8 E. | R. 9 E.
T. 14 N.
525 000 FEET
510 000 FEET
770 000 FEET
775 000 FEET
P O S E Y
Little Blue River
Blue River
Meadow Creek
Beaver
Mud Creek
water
25
26
27
30
31
34
35
36

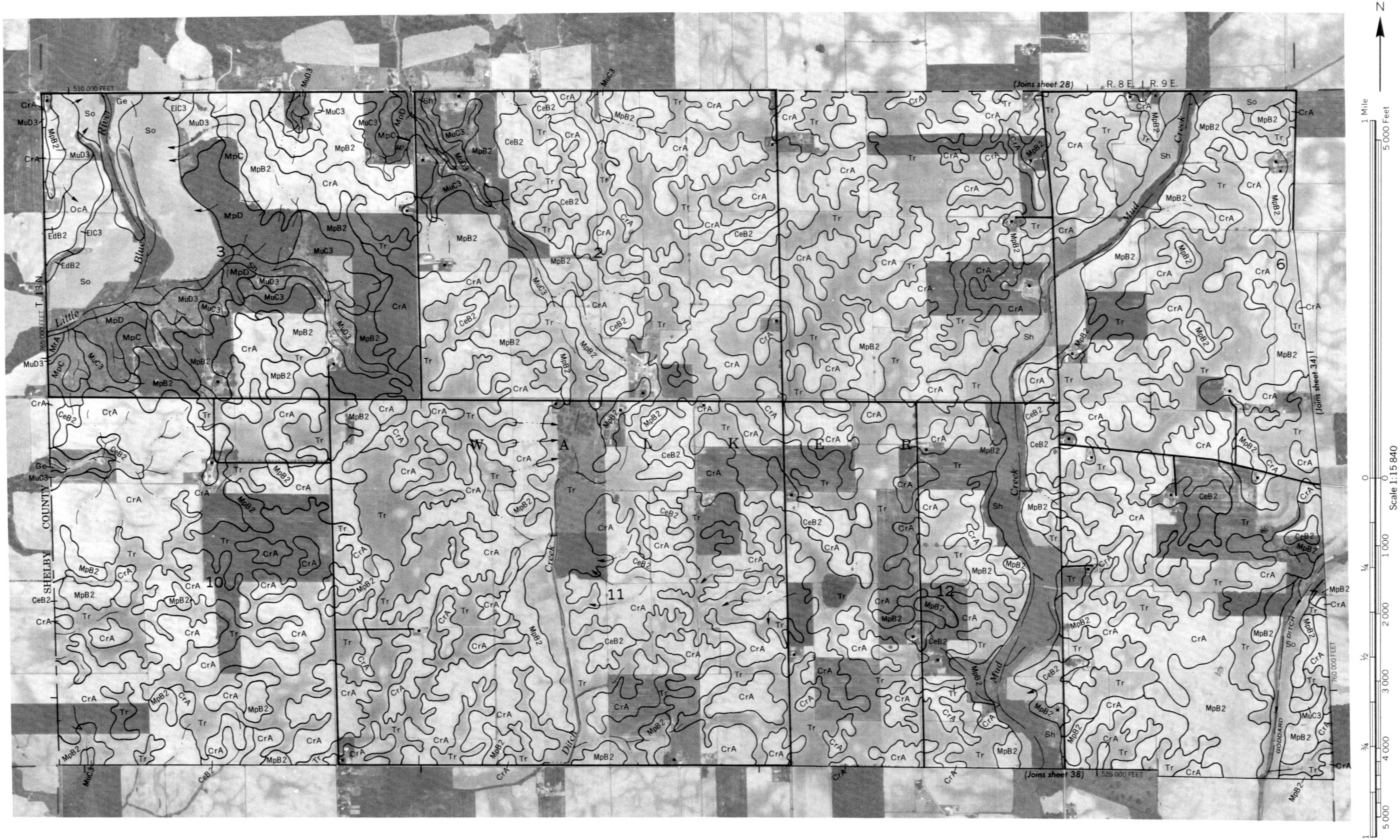

N
(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 34)
R. 9 E.
T. 14 N.
530 000 FEET
775 000 FEET
770 000 FEET
545 000 FEET
Mud Creek
HODGE DITCH
JOHNSON DITCH
Rushing Run
P O S E Y
27
28
29
30
31
32
33
34
CrA
CeB2
MpB2
Tr
So
MuC3
MpD
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

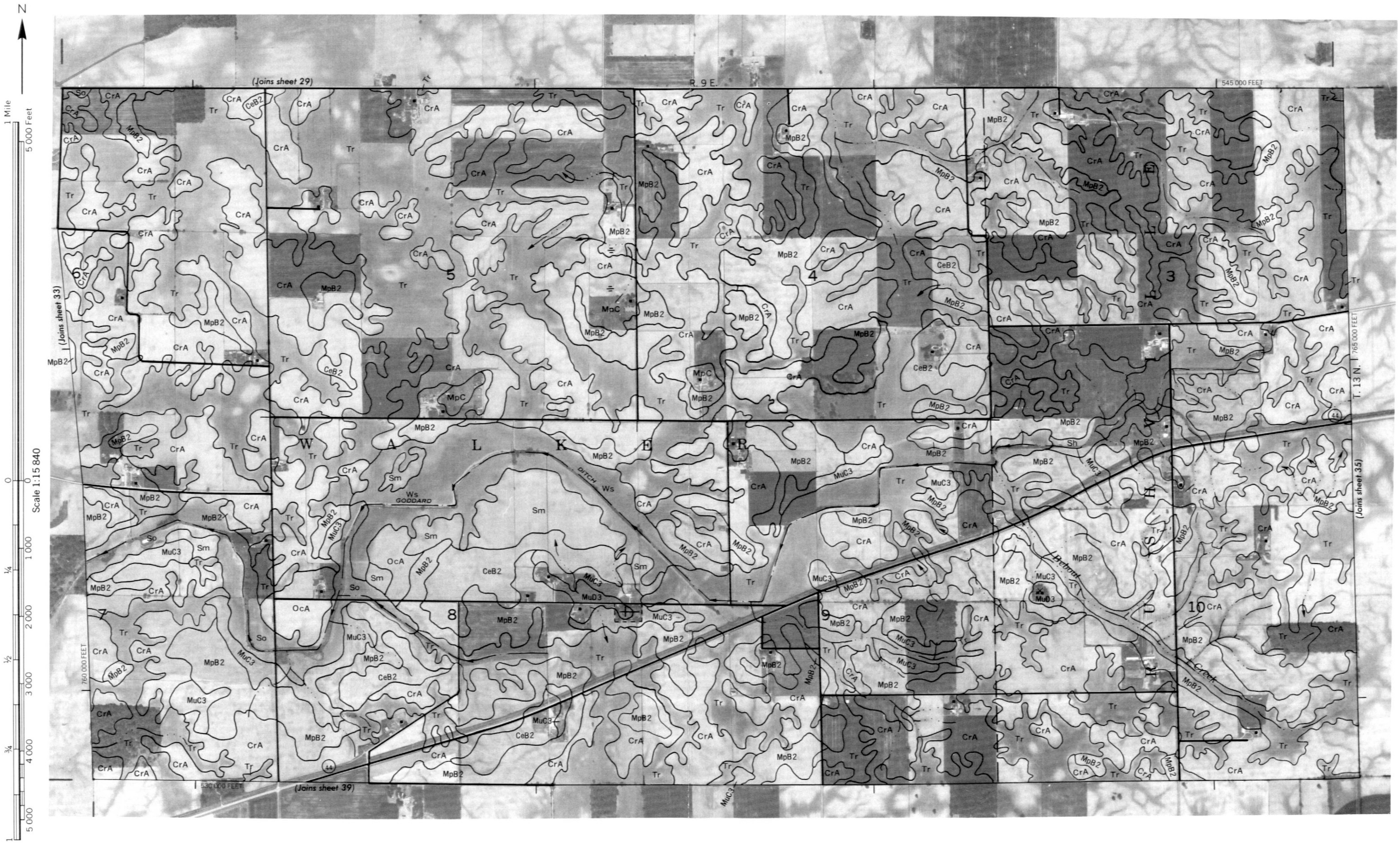

N
1 Mile
5 000 Feet
0
Scale 1:15 840
1 000
¼
2 000
½
3 000
4 000
¾
5 000
(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 35)
R. 9 E. | R. 10 E.
T. 14 N.
565 000 FEET
775 000 FEET
770 000 FEET
550 000 FEET
Rushing
Run
RUSHVILLE
RUSHVILLE
(county seat)


N
R. 10 E.
T. 14 N.
570 000 FEET
580 000 FEET
775 000 FEET
770 000 FEET
(Joins sheet 25)
(Joins sheet 32)
(Joins sheet 36)
(Joins sheet 30)
RUSHVILLE
UNION
Flatrock River
Ben Davis Creek
29
28
27
26
32
33
34
35
44
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

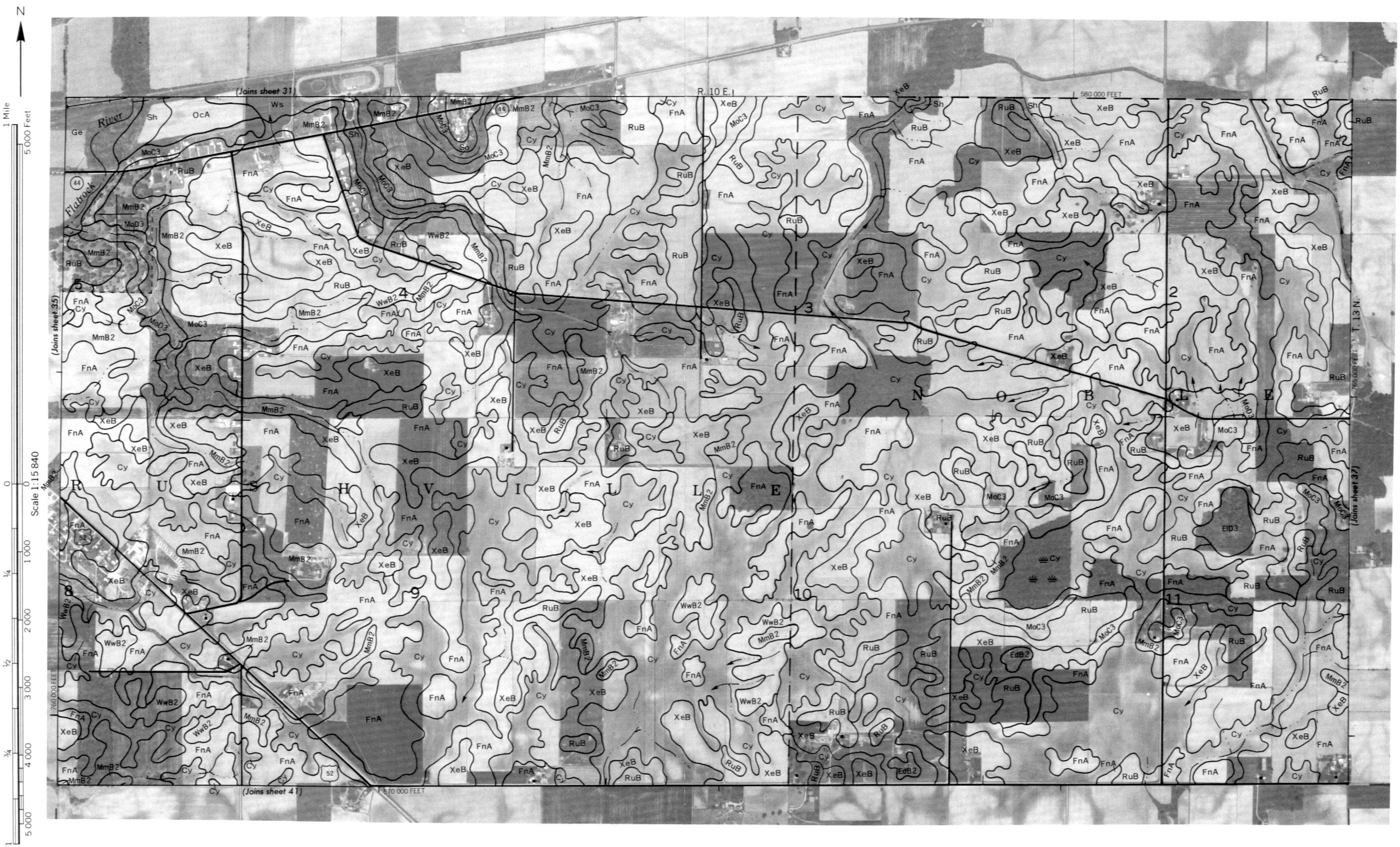
(32)

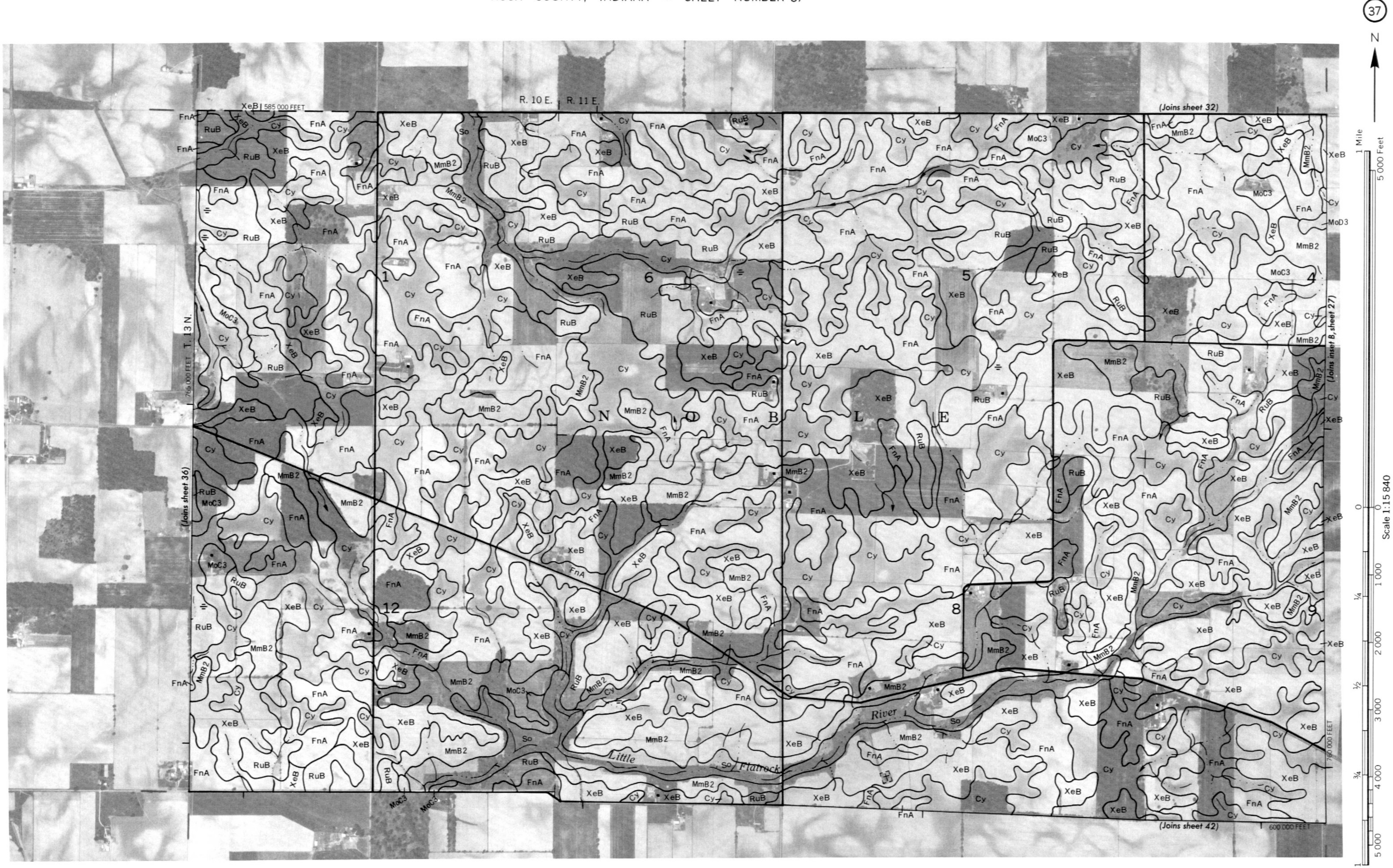

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 26)
R. 10 E.
R. 11 E.
600 000 FEET
780 000 FEET
770 000 FEET
585 000 FEET
(Joins sheet 31)
(Joins sheet 37)
(Joins inset A, sheet 27)
T. 14 N.
Ben Davis Creek
U N I O N
Mauzy
25
30
29
28
36
31
32
33
44

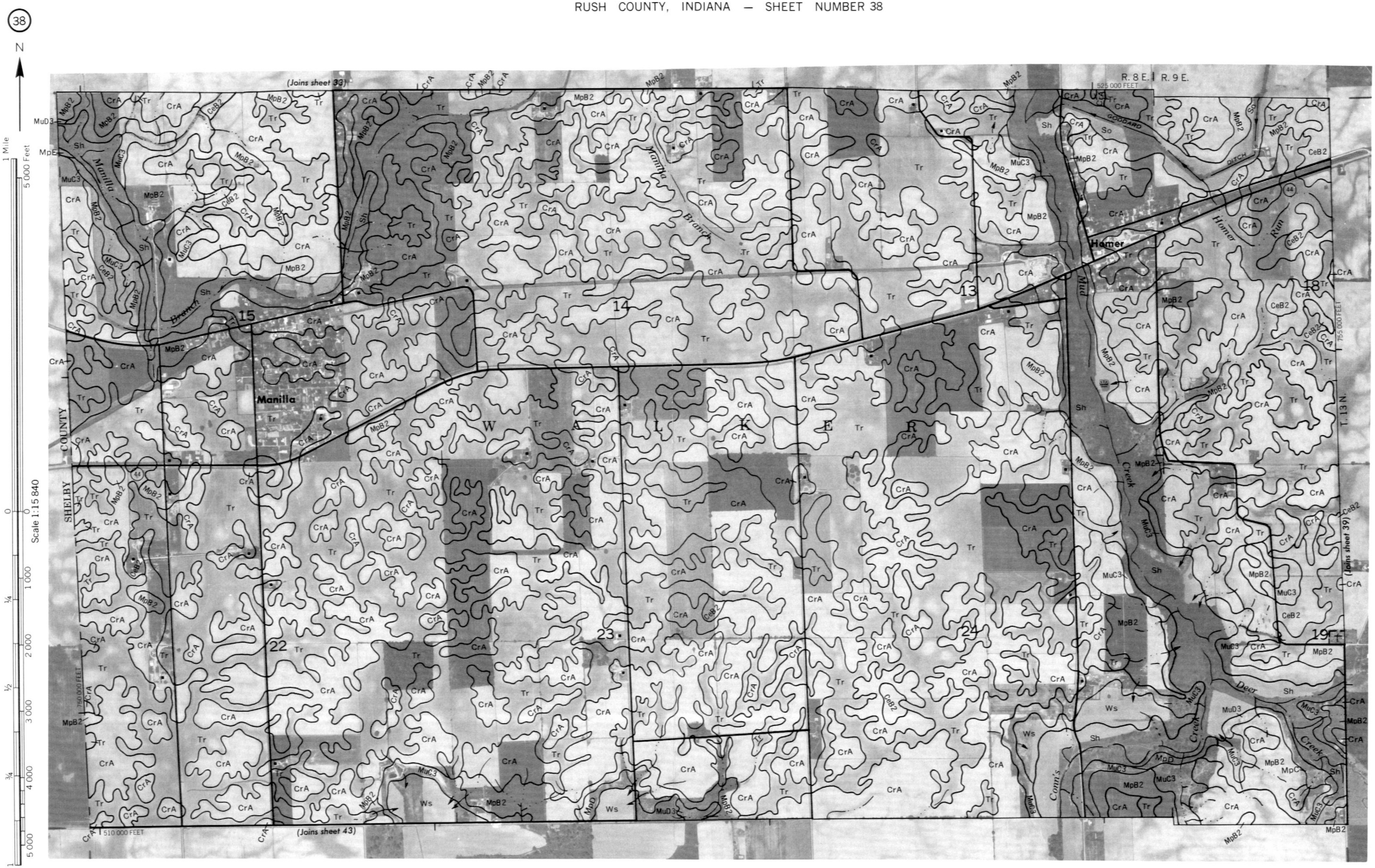

(Joins sheet 28)
R. 8 E.
R. 9 E.
(Joins sheet 34)
(Joins sheet 38)
510 000 FEET
765 000 FEET
525 000 FEET
760 000 FEET
T. 13 N.
SHELBY COUNTY
WALKER
Little Blue River
Mud Creek
Creek
Ditch
GODDARD DITCH
N
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 29)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 39)
R. 9 E.
T. 13 N.
545 000 FEET
765 000 FEET
760 000 FEET
630 000 FEET
W A L K E R
R U S H
GODDARD DITCH


N
RUSHVILLE
(county seat)
Circleville
Flatrock River
River
water
(Joins sheet 30)
(Joins sheet 36)
(Joins sheet 40)
(Joins sheet 34)
R. 9 E. | R. 10 E.
T. 13 N.
550 000 FEET
565 000 FEET
765 000 FEET
760 000 FEET
R U S H V I L L E
1 Mile
5 000 Feet
Scale 1:15 840

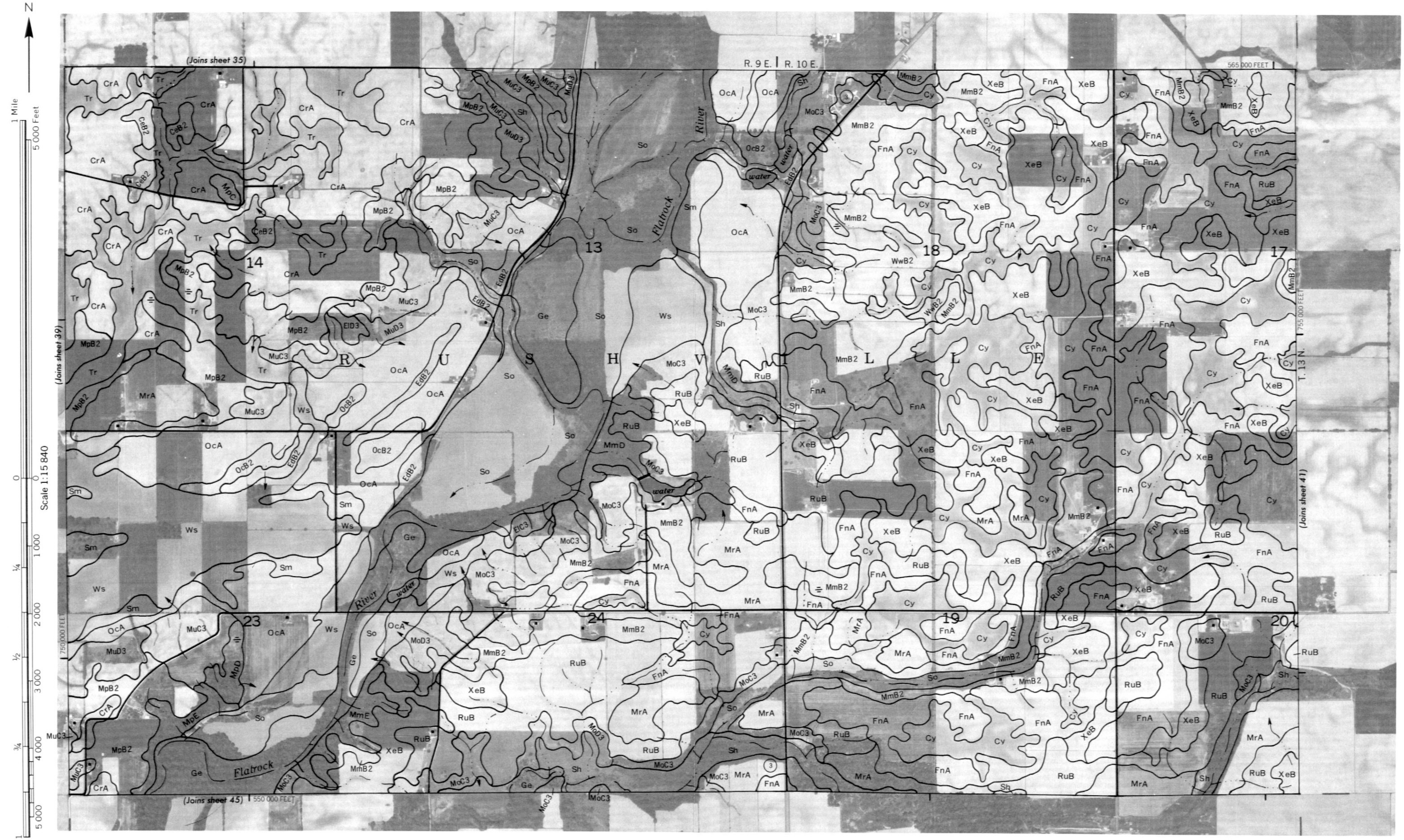

N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
(Joins sheet 31)
R. 10 E.
580 000 FEET
T. 13 N.
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 41)
570 000 FEET
760 000 FEET
765 000 FEET
Flatrock River
RUSHVILLE
NOBLE
44
52

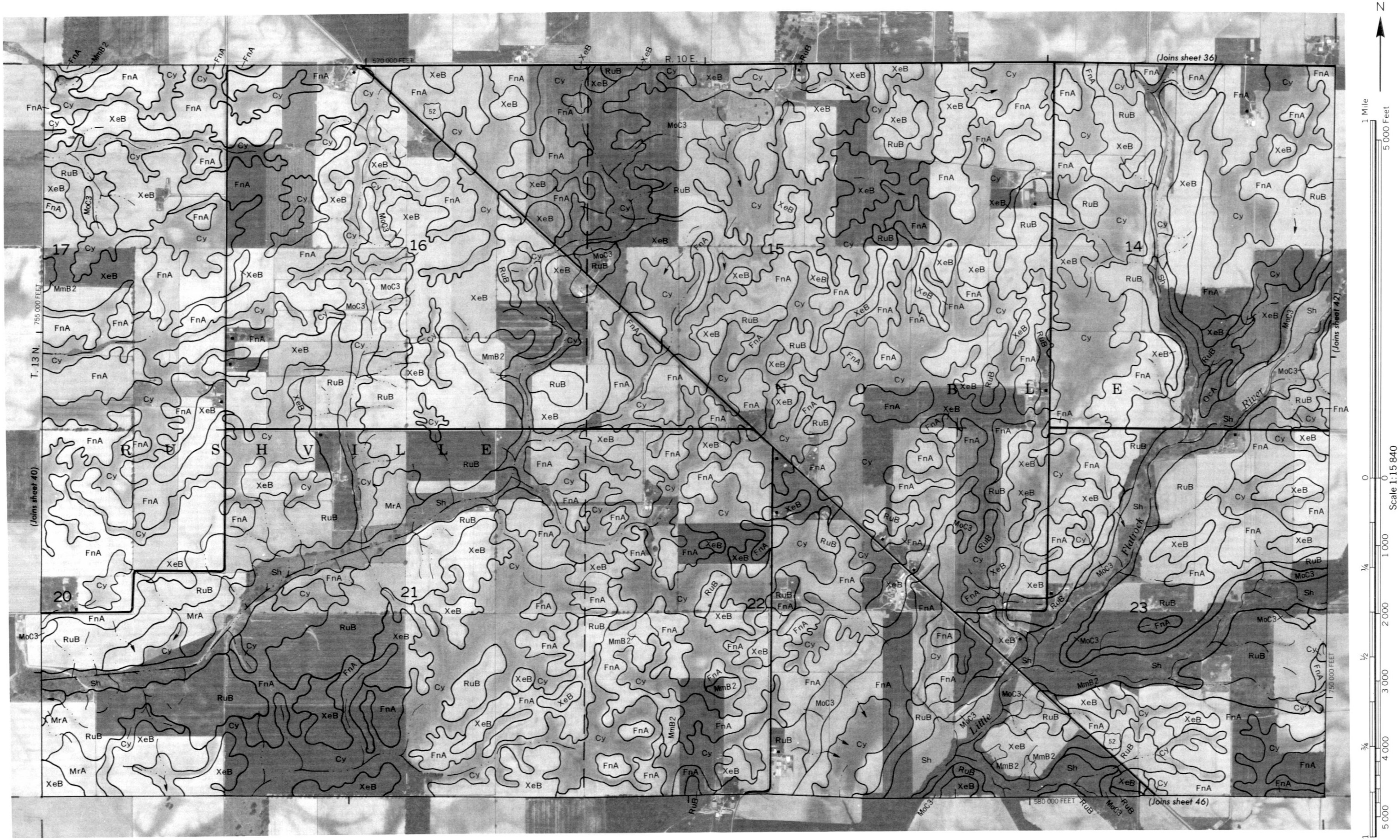

37
N
R. 10 E.
R. 11 E.
T. 13 N.
585 000 FEET
600 000 FEET
765 000 FEET
760 000 FEET
(Joins sheet 32)
(Joins sheet 42)
(Joins sheet 36)
(Joins inset B, sheet 27)
N O B L E
Little Flatrock River
1 Mile
5 000 Feet
Scale 1:15 840
XeB
Cy
FnA
RuB
MmB2
MoC3
MoD3
So

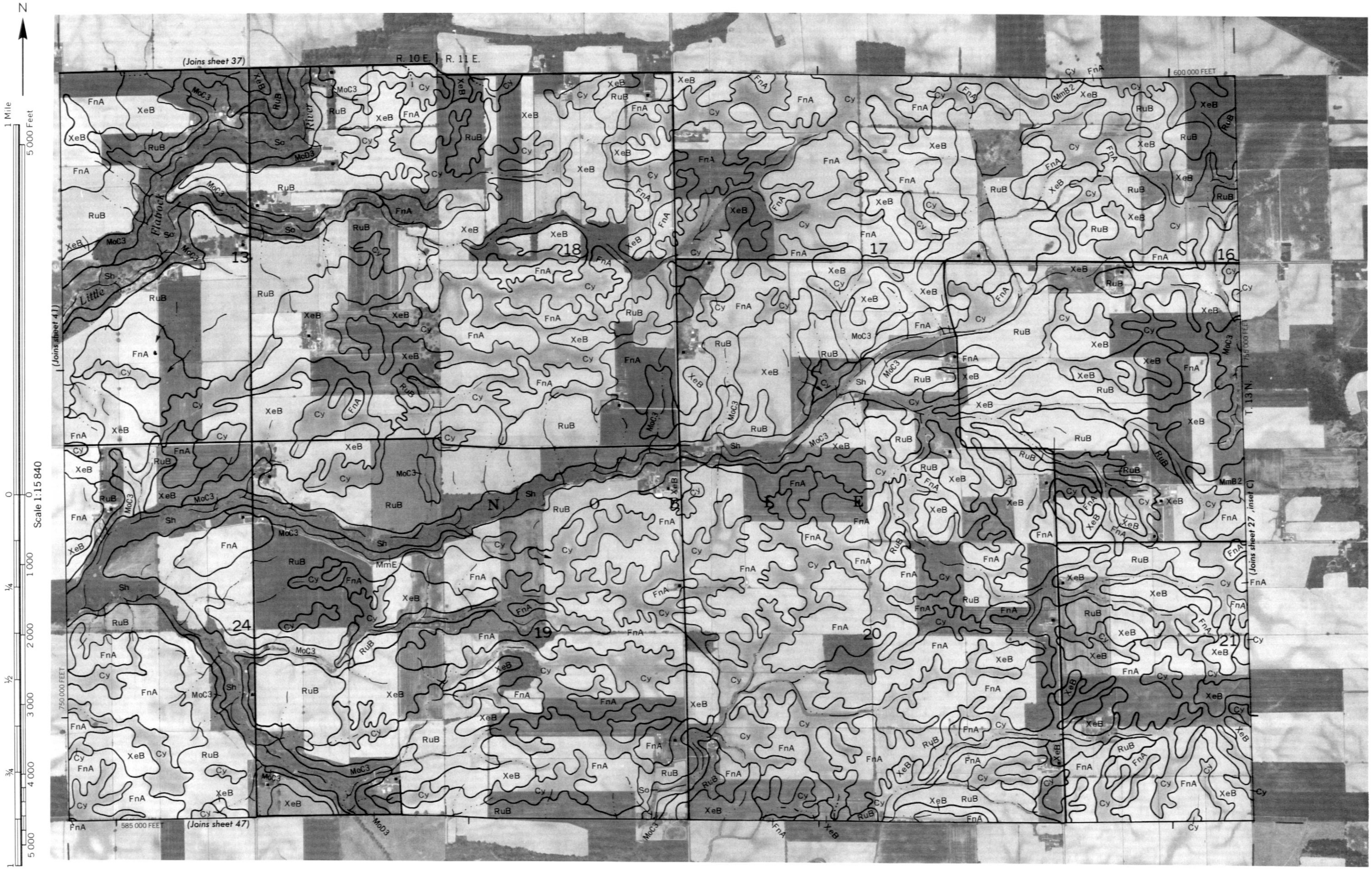

38
N
(Joins sheet 33)
(Joins sheet 43)
(Joins sheet 39)
R. 8 E. | R. 9 E.
T. 13 N.
525 000 FEET
755 000 FEET
750 000 FEET
510 000 FEET
Manilla
Homer
W A L K E R
SHELBY COUNTY
Manilla Branch
Mud Creek
Homer Run
Goddard Ditch
Deer Creek
Conn's Creek
13
14
15
18
19
22
23
24
Scale 1:15 840
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

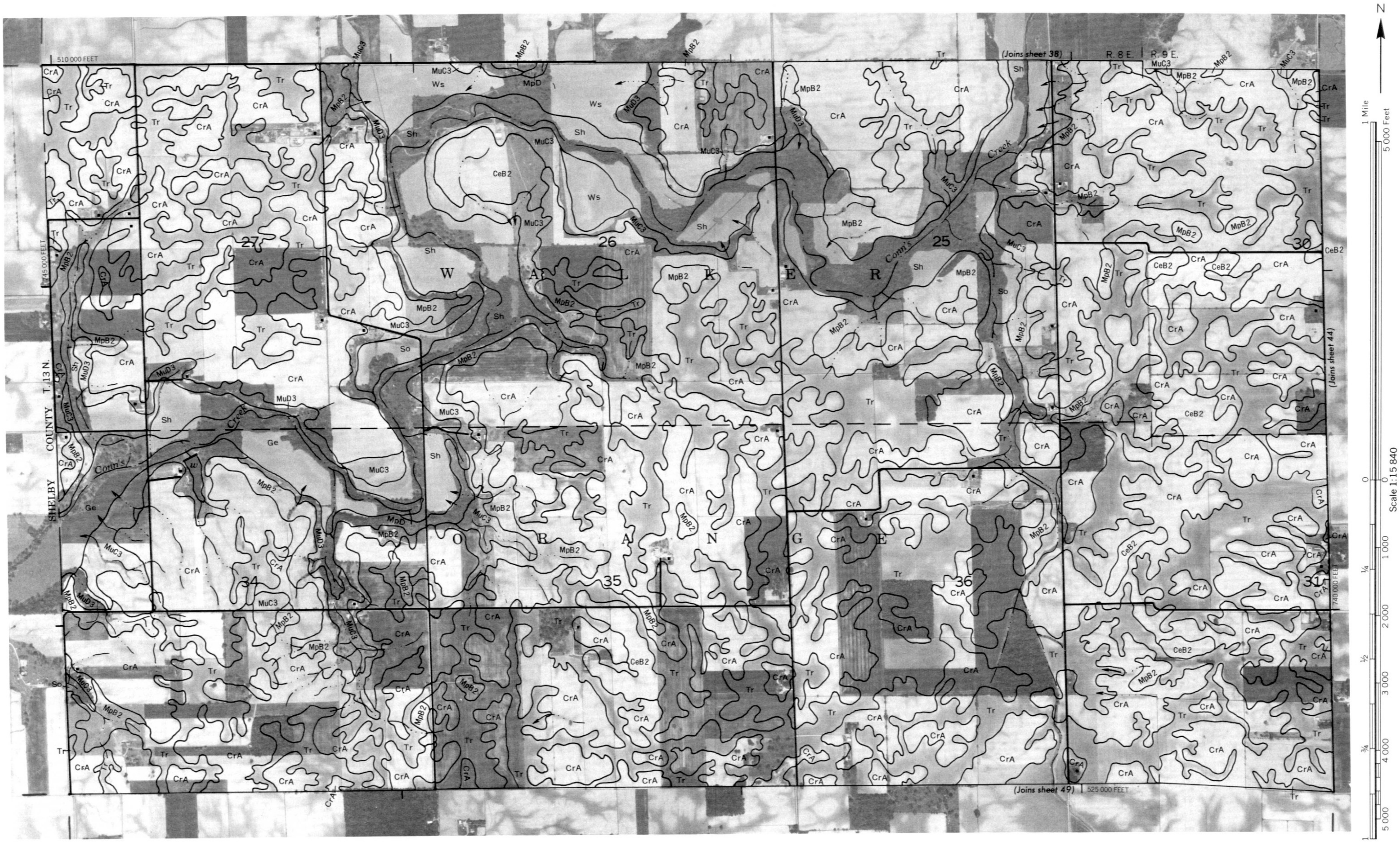

N
530 000 FEET
R. 9 E.
(Joins sheet 34)
T. 13 N.
755 000 FEET
(Joins sheet 38)
(Joins sheet 40)
750 000 FEET
(Joins sheet 44)
545 000 FEET
Homer Run
South Creek
Branan Creek
WALKER
LIVERPOOL
18
17
16
15
19
20
21
22
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

40

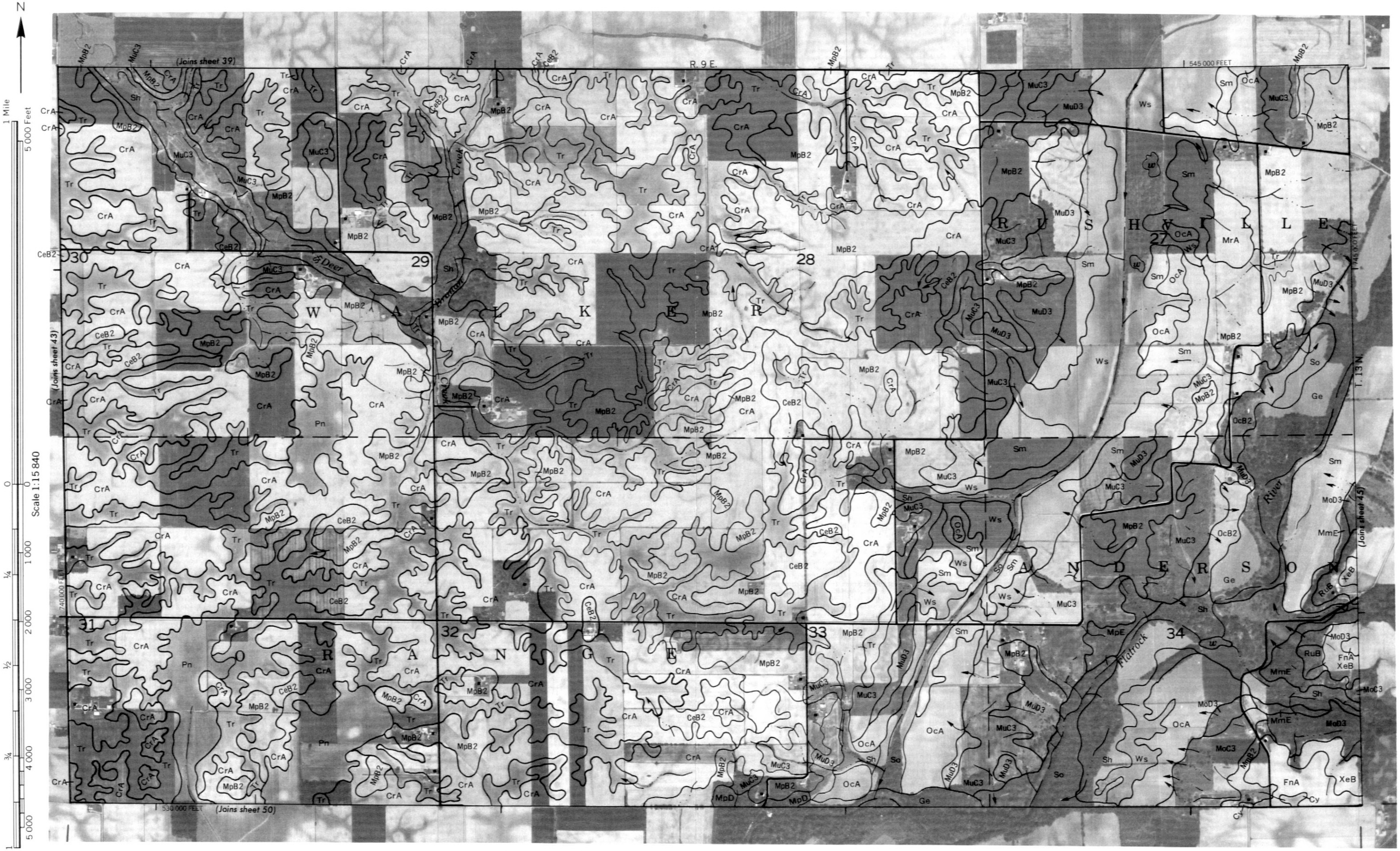

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 35)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 45)
R. 9 E. | R. 10 E.
T. 13 N.
565 000 FEET
550 000 FEET
755 000 FEET
750 000 FEET
RUSH VILLE
Flatrock River
13
14
17
18
19
20
23
24

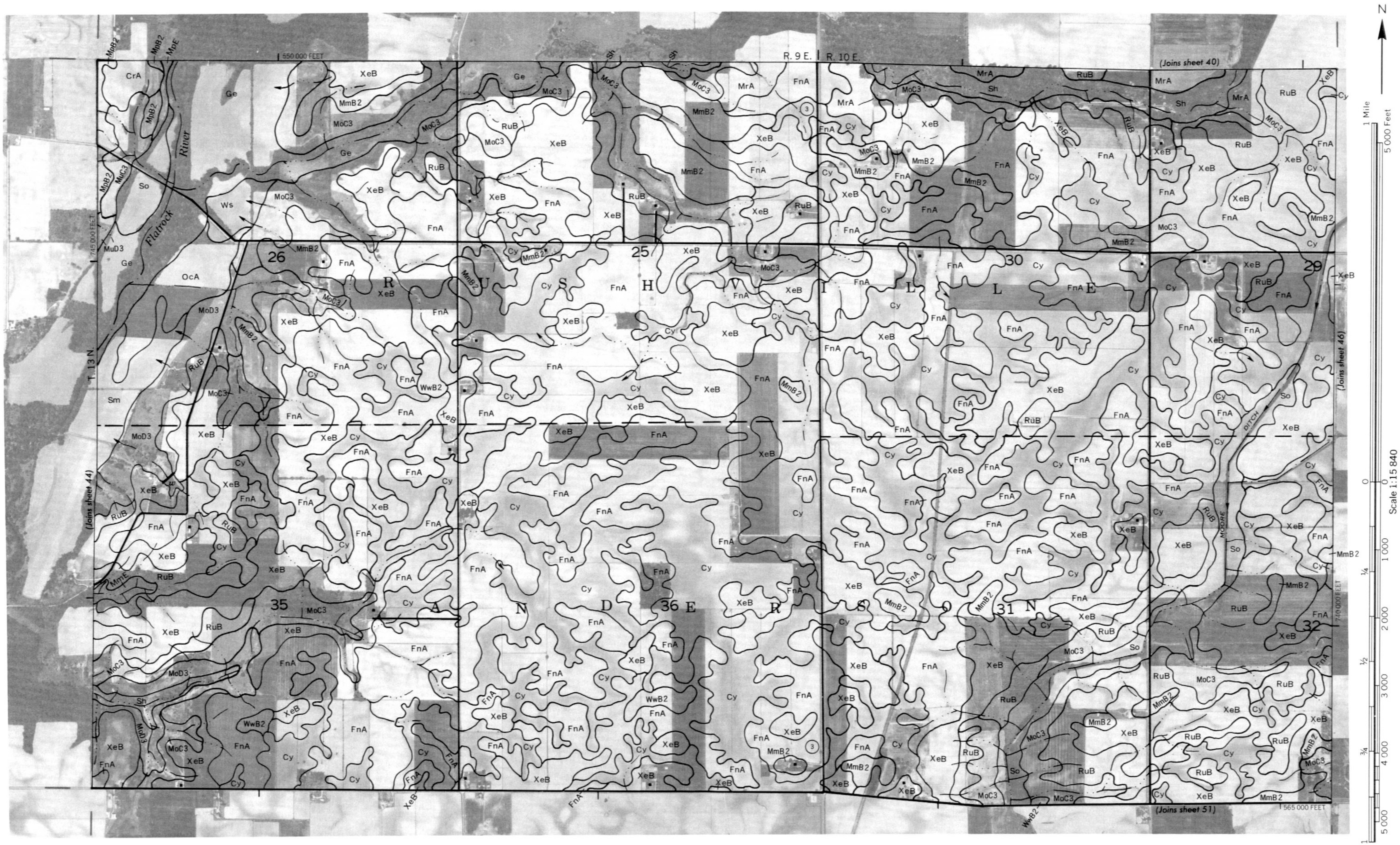



N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 37)
R. 10 E.
R. 11 E.
600 000 FEET
(Joins sheet 41)
T. 13 N.
750 000 FEET
(Joins sheet 27, inset C)
585 000 FEET
(Joins sheet 47)
Little Flatrock River
NOBLE
13
18
17
16
24
19
20
21


N
510 000 FEET
(Joins sheet 38)
R. 8 E.
R. 9 E.
745 000 FEET
SHELBY COUNTY
T. 13 N.
(Joins sheet 44)
740 000 FEET
(Joins sheet 49)
525 000 FEET
W A L K E R
O R A N G E
27
26
25
30
34
35
36
31
Conn's Creek
CrA
Tr
MpB2
MuC3
MuD3
MpD
Ws
Sh
So
Ge
CeB2
w
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
2000
3000
4000
5 000
1/4
1/2
3/4
1

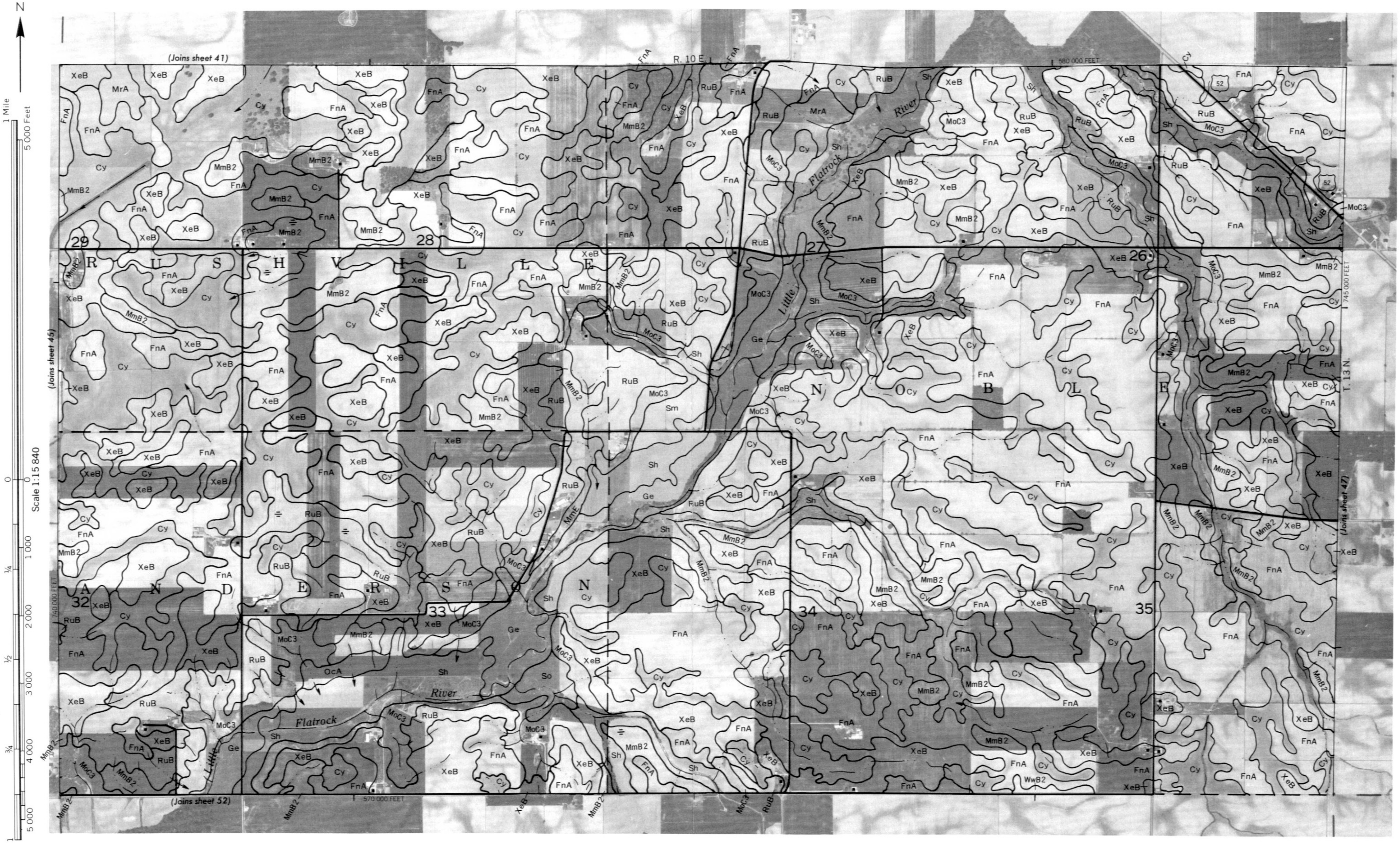
RUSH COUNTY, INDIANA — SHEET NUMBER 44

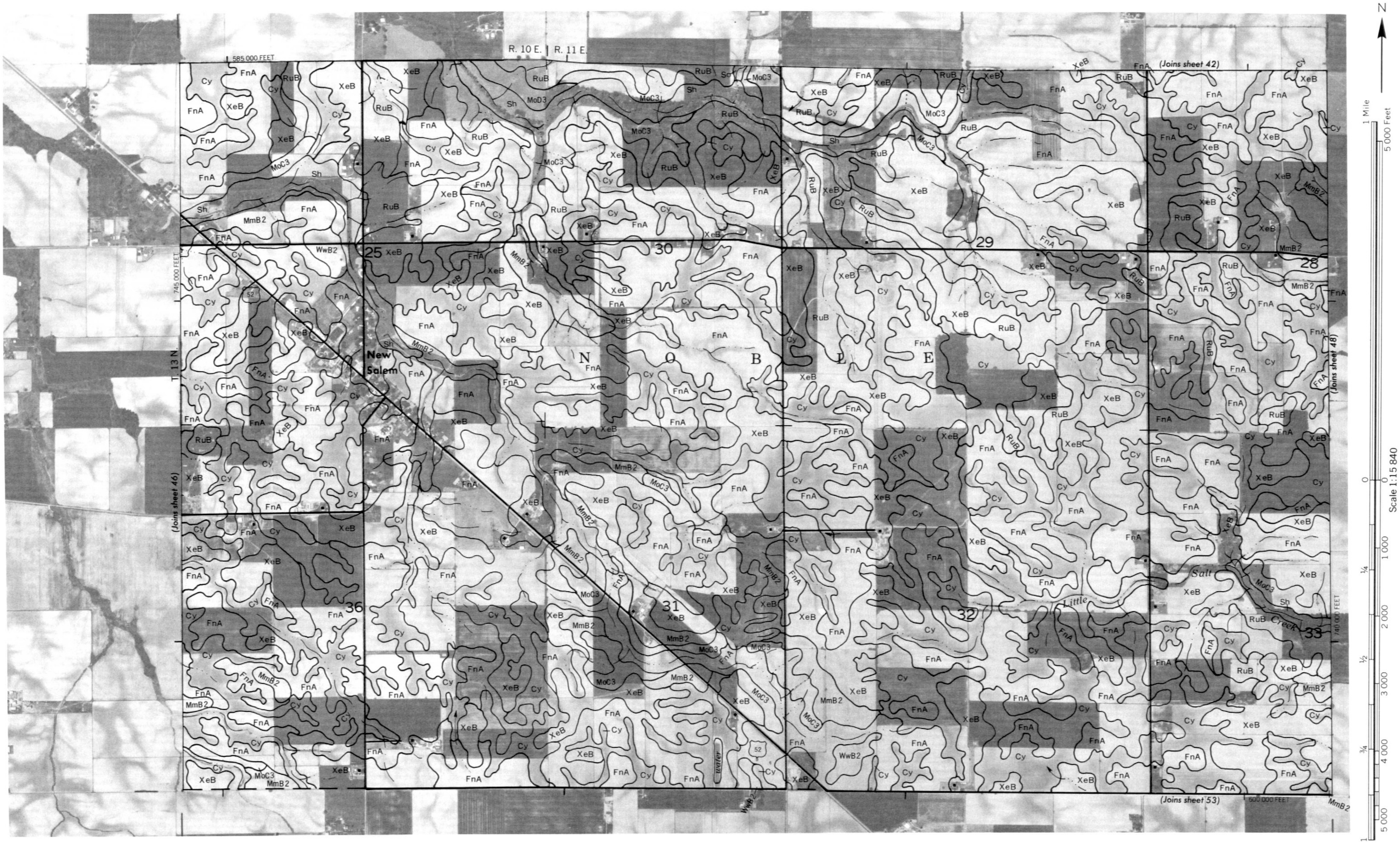


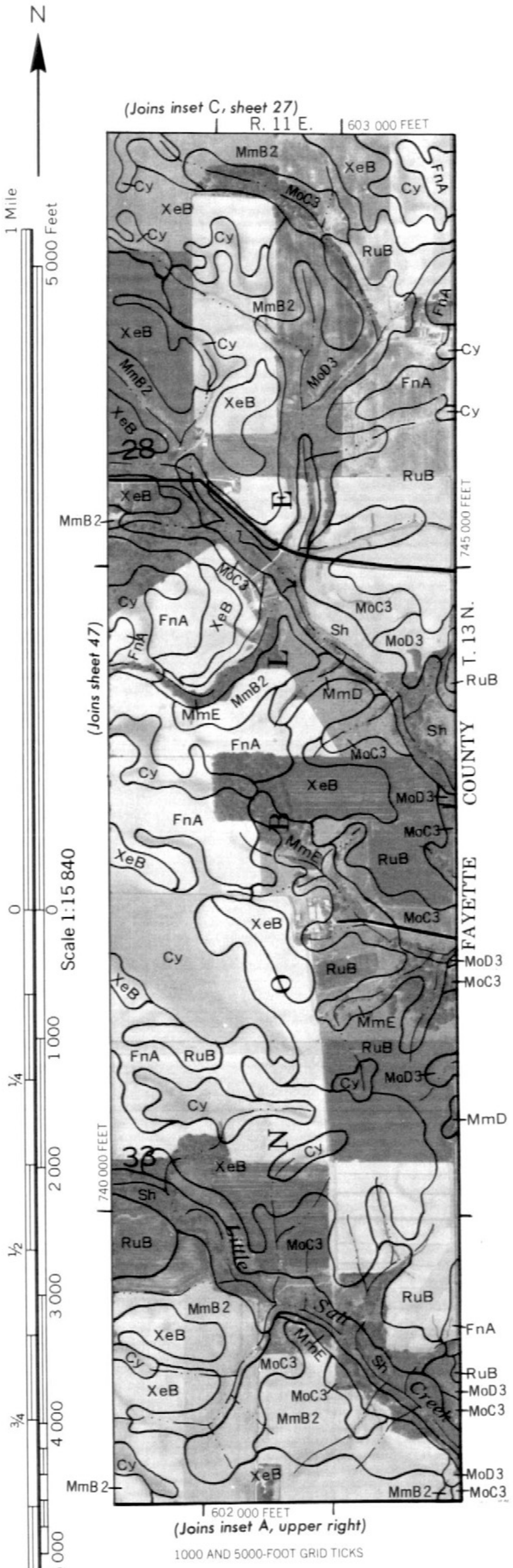

(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 51)
(Joins sheet 44)
R. 9 E.
R. 10 E.
T. 13 N.
550 000 FEET
565 000 FEET
745 000 FEET
740 000 FEET
Flatrock River
RUSHVILLE
ANDERSON
MOORE DITCH
26
25
30
29
35
36
31
32
N
1 Mile
5 000 Feet
Scale 1:15 840

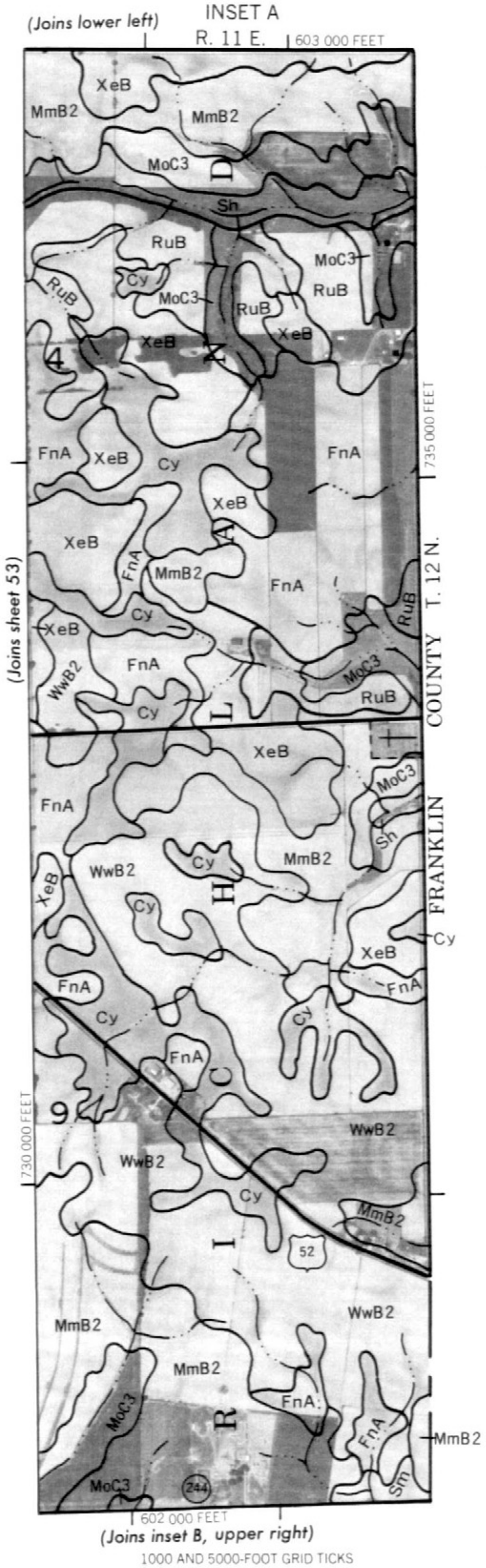
46

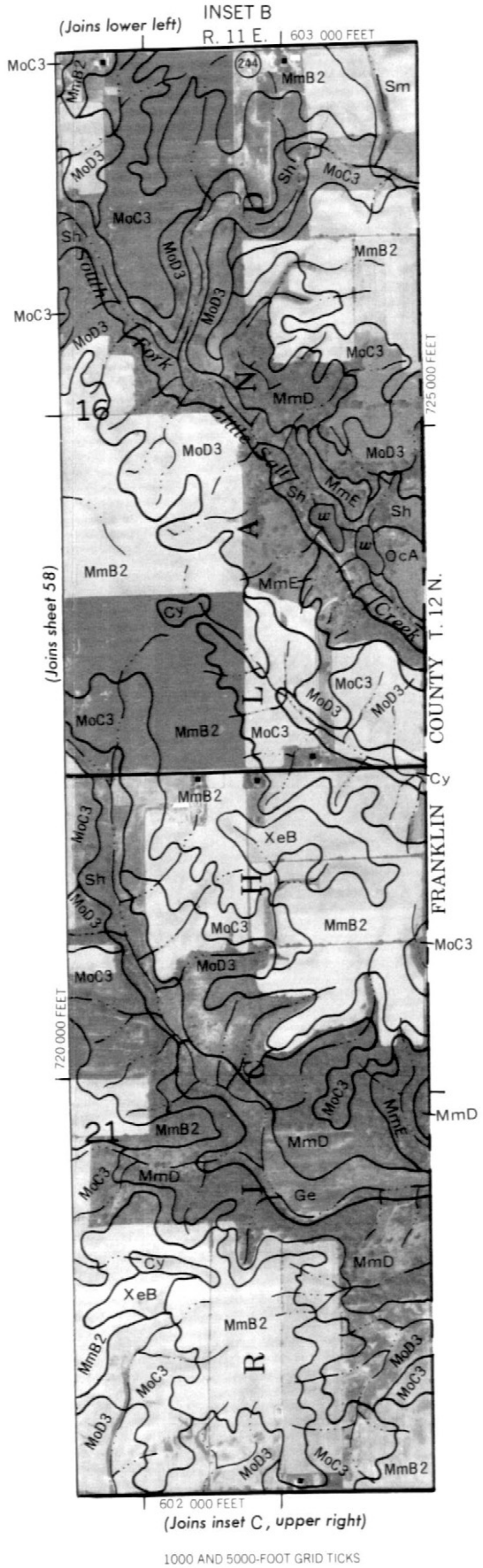
RUSH COUNTY, INDIANA — SHEET NUMBER 46

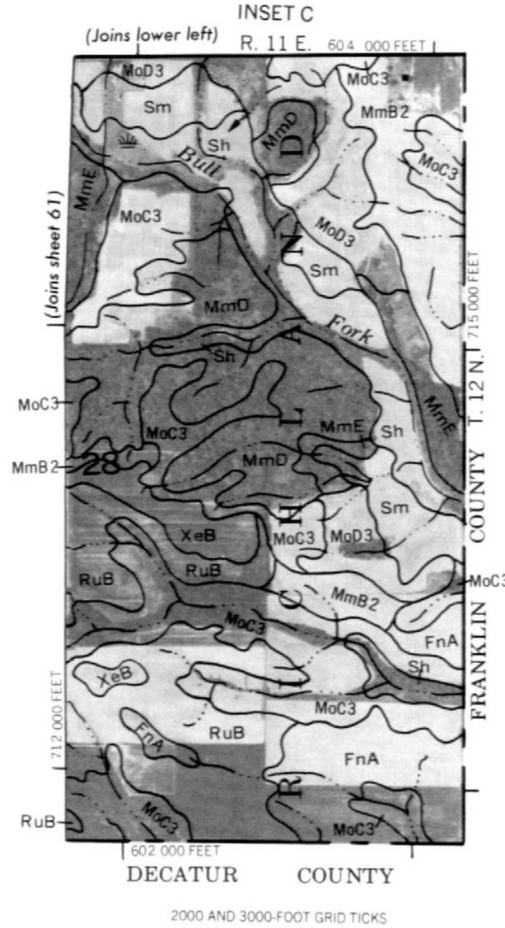


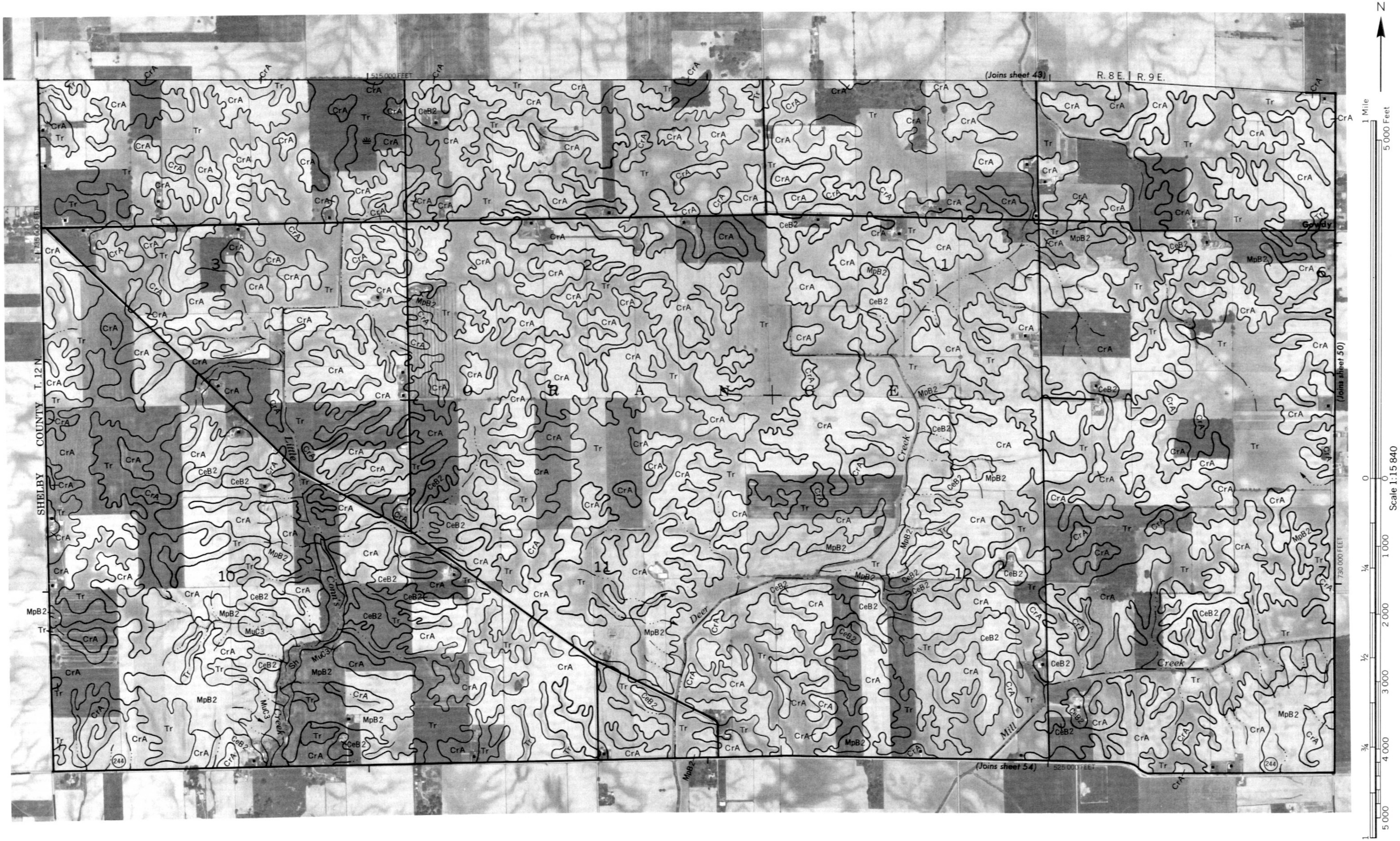

N
R. 10 E. | R. 11 E.
585 000 FEET
745 000 FEET
740 000 FEET
600 000 FEET
T. 13 N.
(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 53)
(Joins sheet 46)
New Salem
N O B L E
Salt
Little
Creek
25
30
29
28
36
31
32
33
52
water
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾

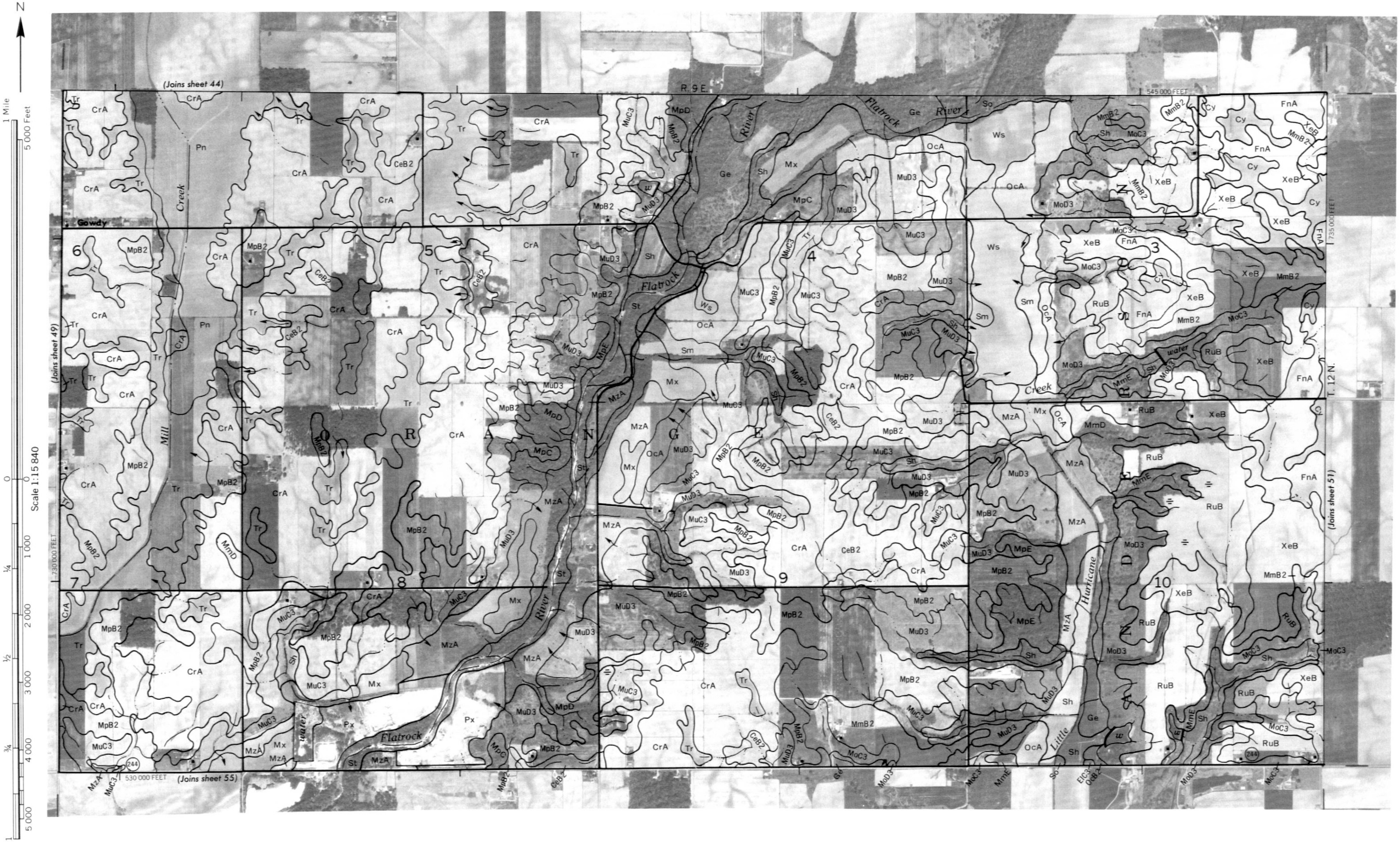

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins inset C, sheet 27)
R. 11 E.
603 000 FEET
745 000 FEET
740 000 FEET
(Joins sheet 47)
T. 13 N.
FAYETTE COUNTY
602 000 FEET
(Joins inset A, upper right)
1000 AND 5000-FOOT GRID TICKS

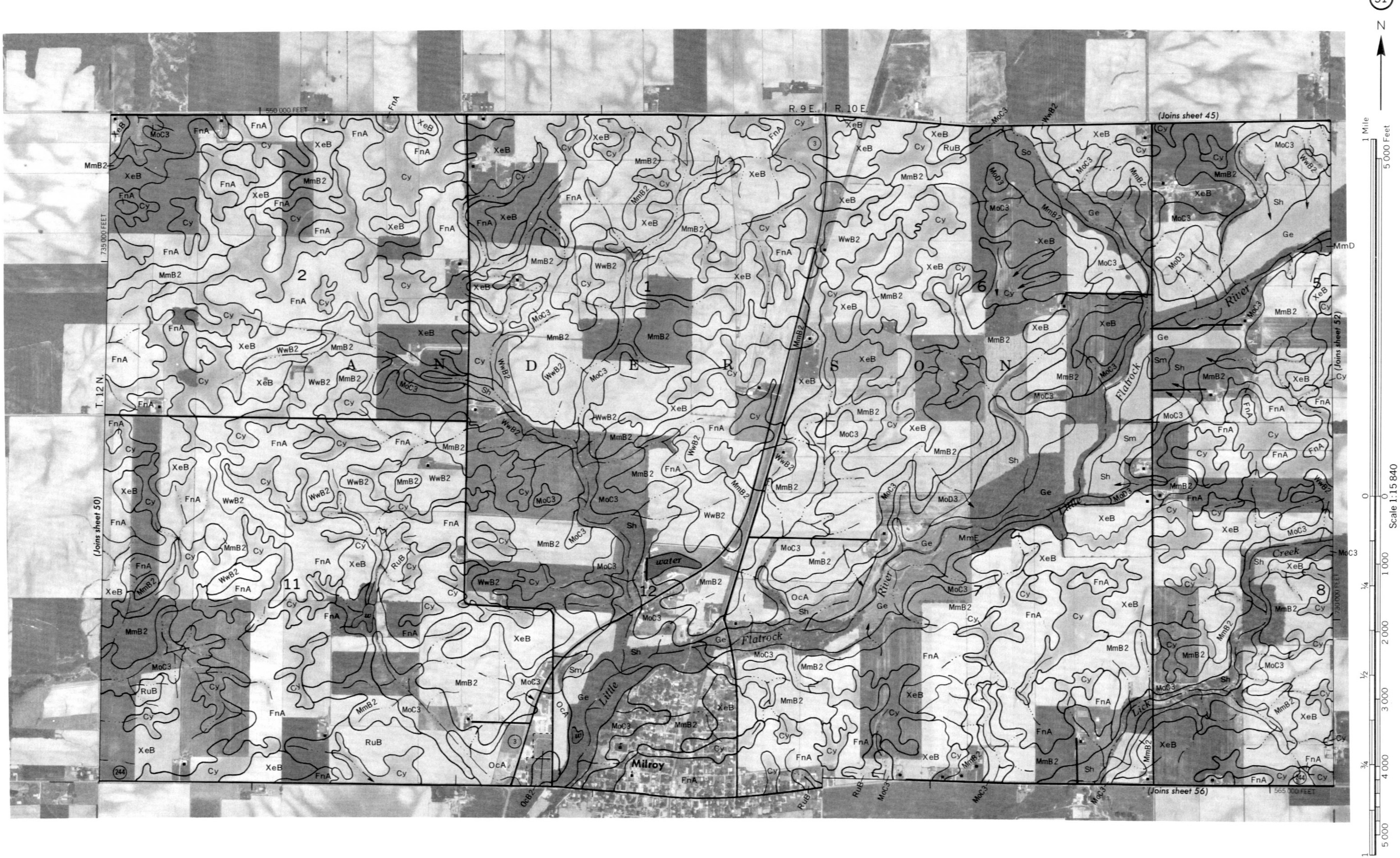

INSET A
(Joins lower left)
R. 11 E.
603 000 FEET
735 000 FEET
730 000 FEET
(Joins sheet 53)
T. 12 N.
FRANKLIN COUNTY
602 000 FEET
(Joins inset B, upper right)
1000 AND 5000-FOOT GRID TICKS

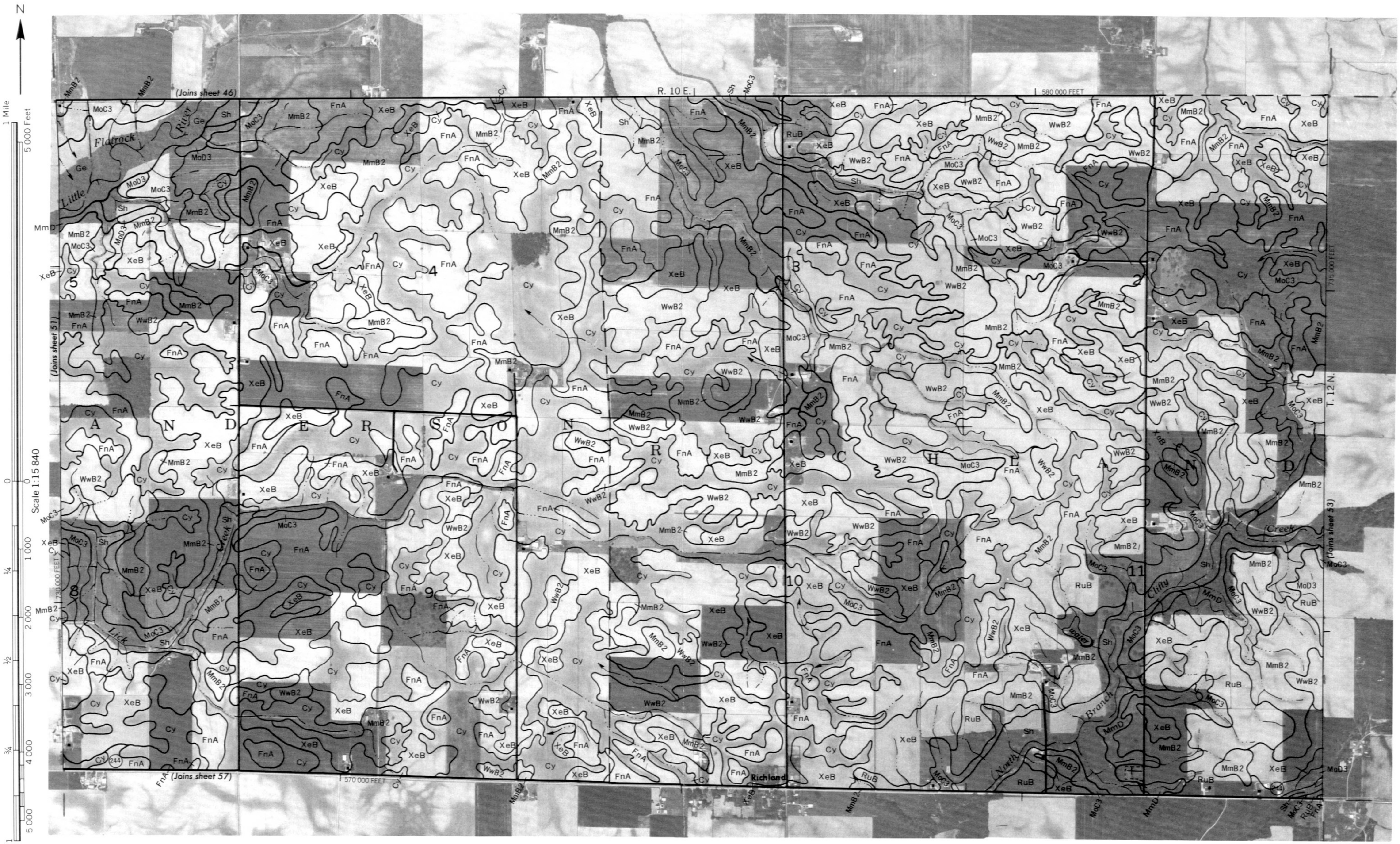

INSET B
(Joins lower left)
R. 11 E.
603 000 FEET
725 000 FEET
720 000 FEET
(Joins sheet 58)
T. 12 N.
FRANKLIN COUNTY
602 000 FEET
(Joins inset C, upper right)
1000 AND 5000-FOOT GRID TICKS

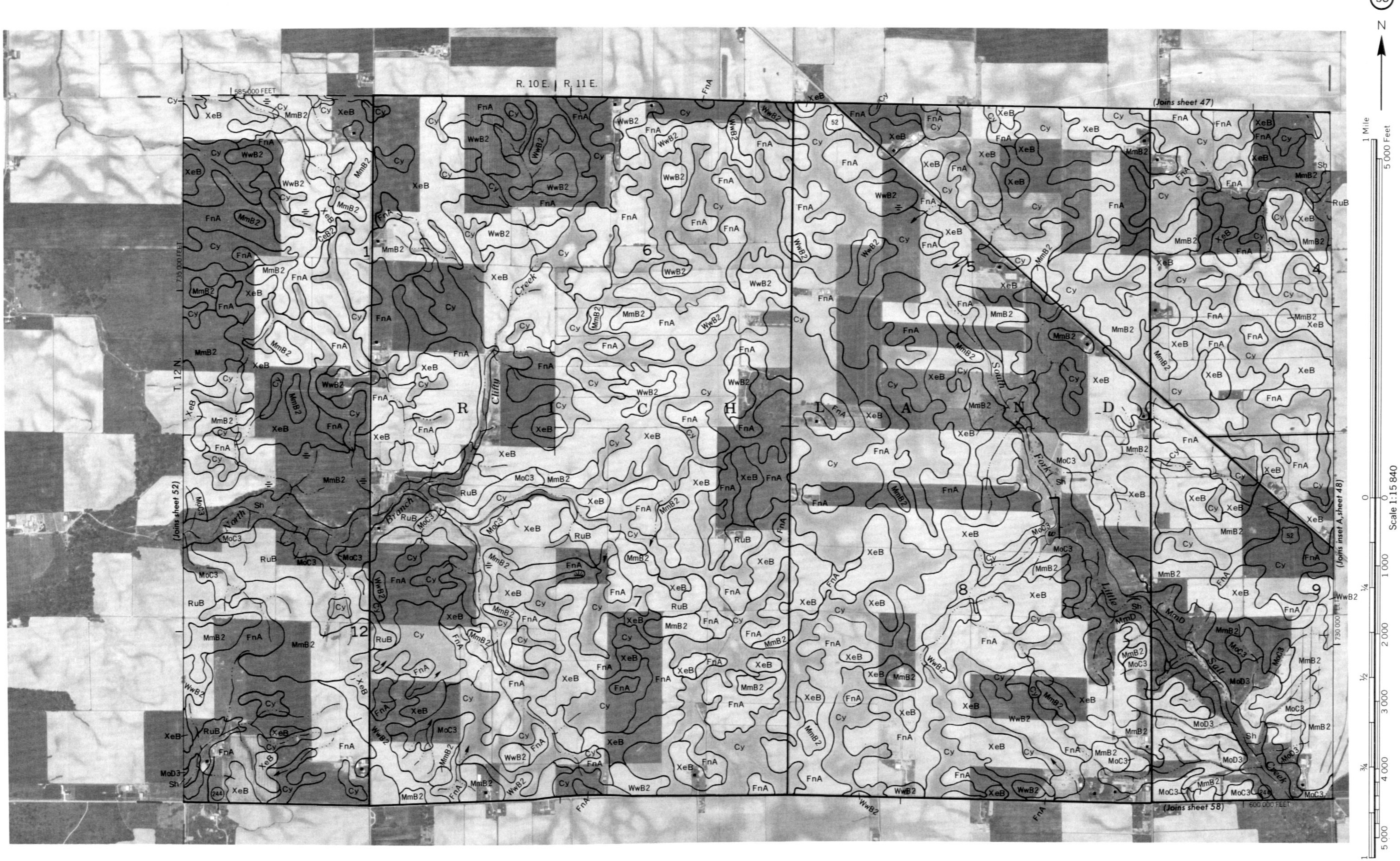

INSET C
(Joins lower left)
R. 11 E.
604 000 FEET
715 000 FEET
712 000 FEET
(Joins sheet 61)
T. 12 N.
FRANKLIN COUNTY
602 000 FEET
DECATUR COUNTY
2000 AND 3000-FOOT GRID TICKS

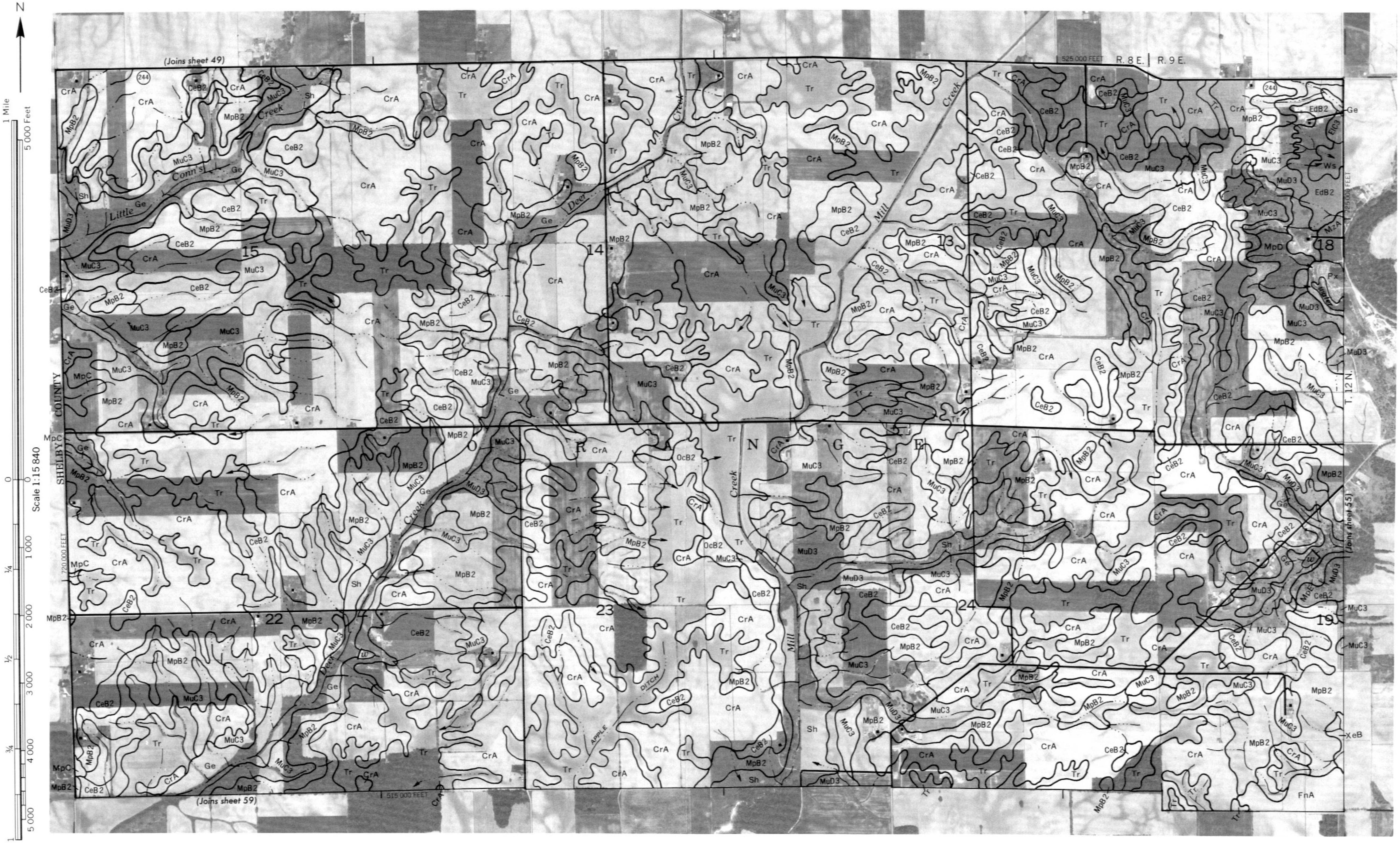

(Joins sheet 43)
515 000 FEET
R. 8 E.
R. 9 E.
Gowdy
(Joins sheet 50)
(Joins sheet 54)
525 000 FEET
730 000 FEET
735 000 FEET
SHELBY COUNTY
T. 12 N.
O R A N G E
Little
Conn's
Creek
Deer
Mill
Creek
CrA
Tr
CeB2
MpB2
MuC3
244
N
1 Mile
5 000 Feet
Scale 1:15 840

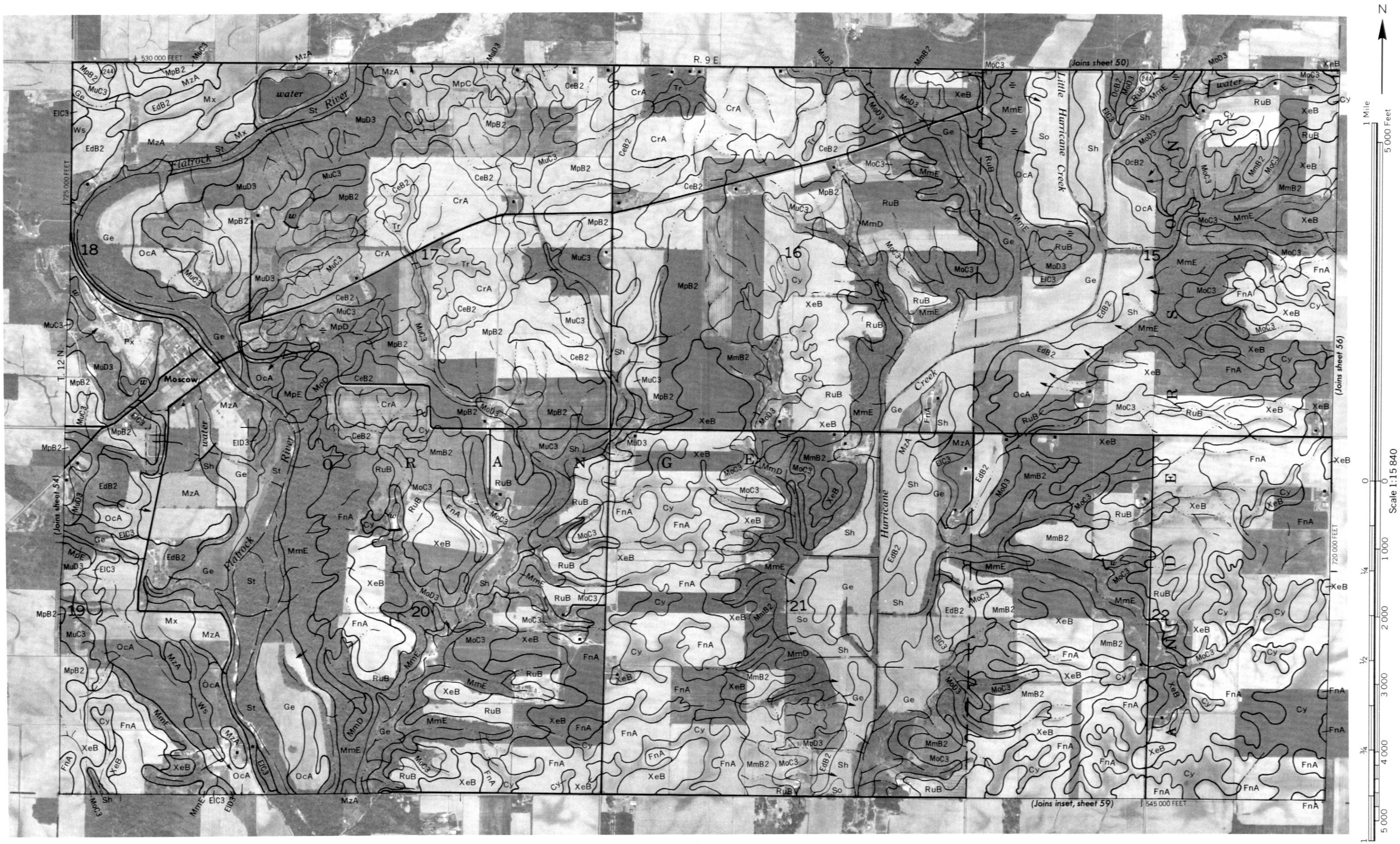

N
(Joins sheet 44)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 55)
Scale 1:15 840
1 Mile
5 000 Feet
R. 9 E.
T. 12 N.
545 000 FEET
735 000 FEET
730 000 FEET
530 000 FEET
Gowdy
Mill
Creek
Flatrock
River
Little
Hurricane
Creek
water
244


51
N
(Joins sheet 45)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 56)
R. 9 E.
R. 10 E.
T. 12 N.
550 000 FEET
565 000 FEET
735 000 FEET
730 000 FEET
A N D E R S O N
Milroy
Flatrock
Little Flatrock River
Flatrock River
Little River
Lick Creek
water
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
1
2
5
6
8
11
12
FnA
XeB
Cy
MoC3
MmB2
WwB2
MoD3
Ge
Sh
Sm
So
RuB
OcA
OcB2
MmD
MmE
3
244

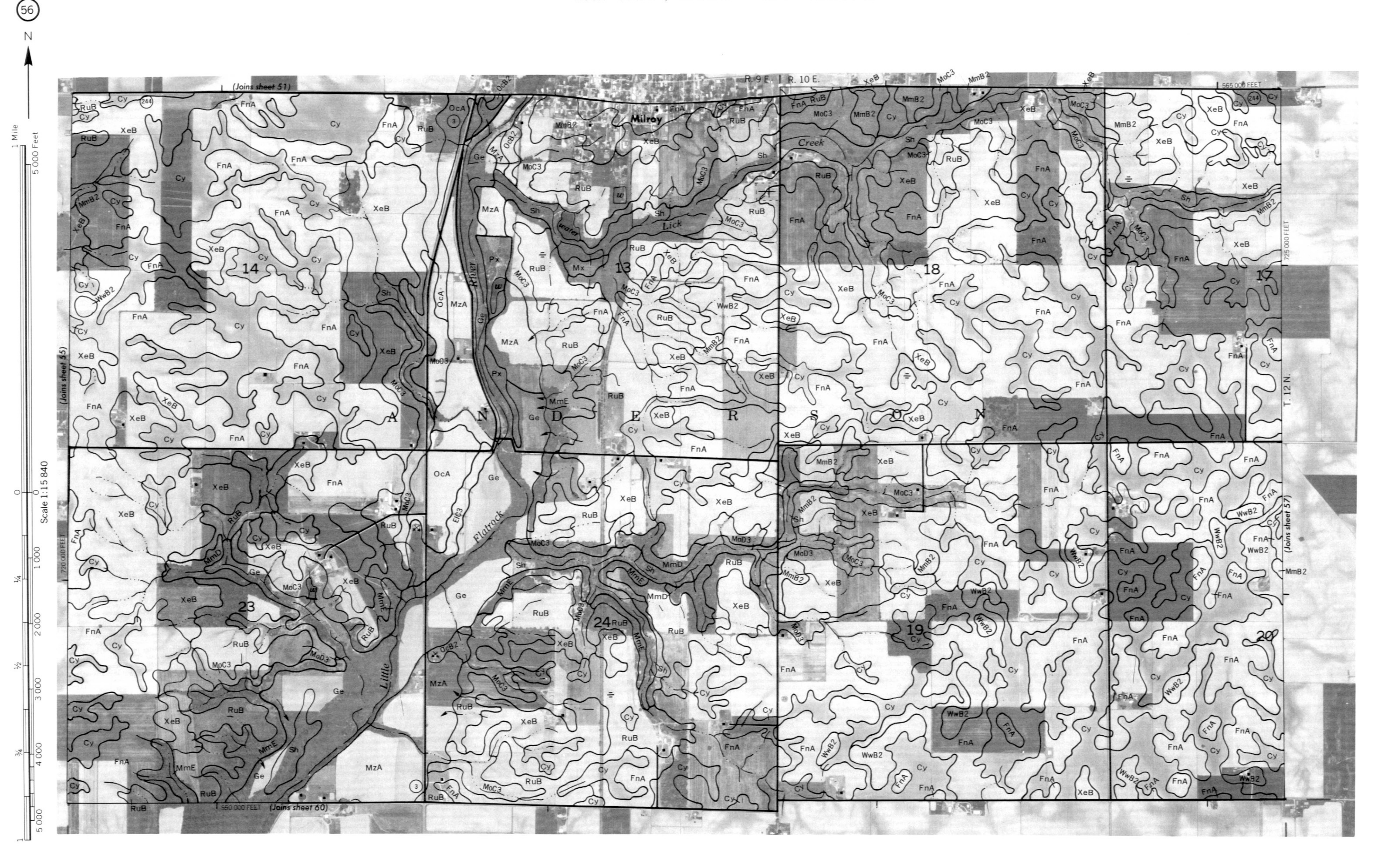

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 46)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 57)
R. 10 E.
T. 12 N.
580 000 FEET
570 000 FEET
730 000 FEET
735 000 FEET
Little Flatrock River
Lick Creek
Clifty Creek
North Branch
Richland
A N D E R S O N
R I C H L A N D
3
4
5
8
9
10
11
2

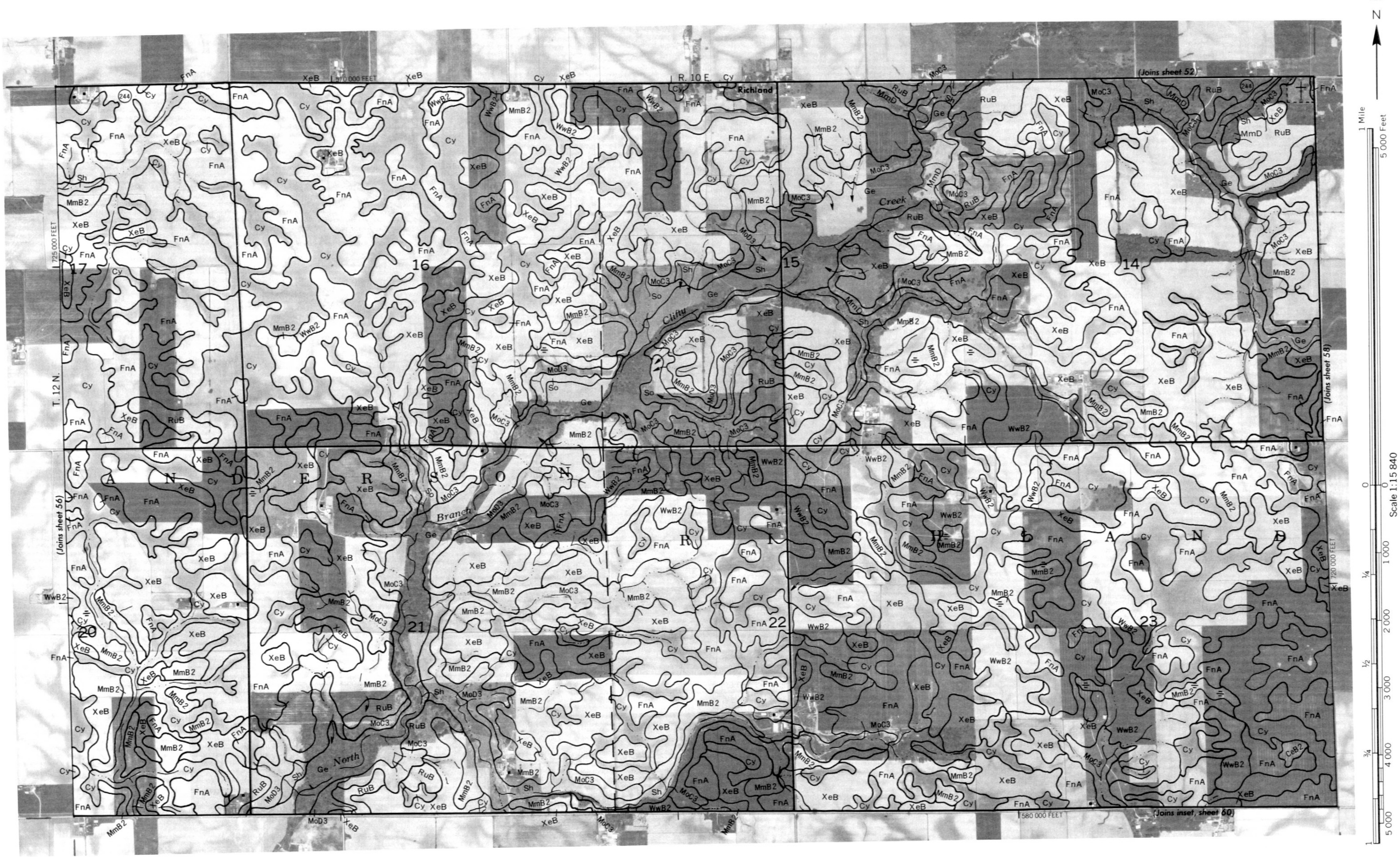

53
N
R. 10 E. | R. 11 E.
T. 12 N.
585 000 FEET
735 000 FEET
730 000 FEET
600 000 FEET
(Joins sheet 47)
(Joins sheet 52)
(Joins inset A, sheet 48)
(Joins sheet 58)
R I C H L A N D
Clifty Creek
North Branch
South Fork
Little Salt Creek
1 2 4 5 6 7 8 9 12
52
244
Scale 1:15 840
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

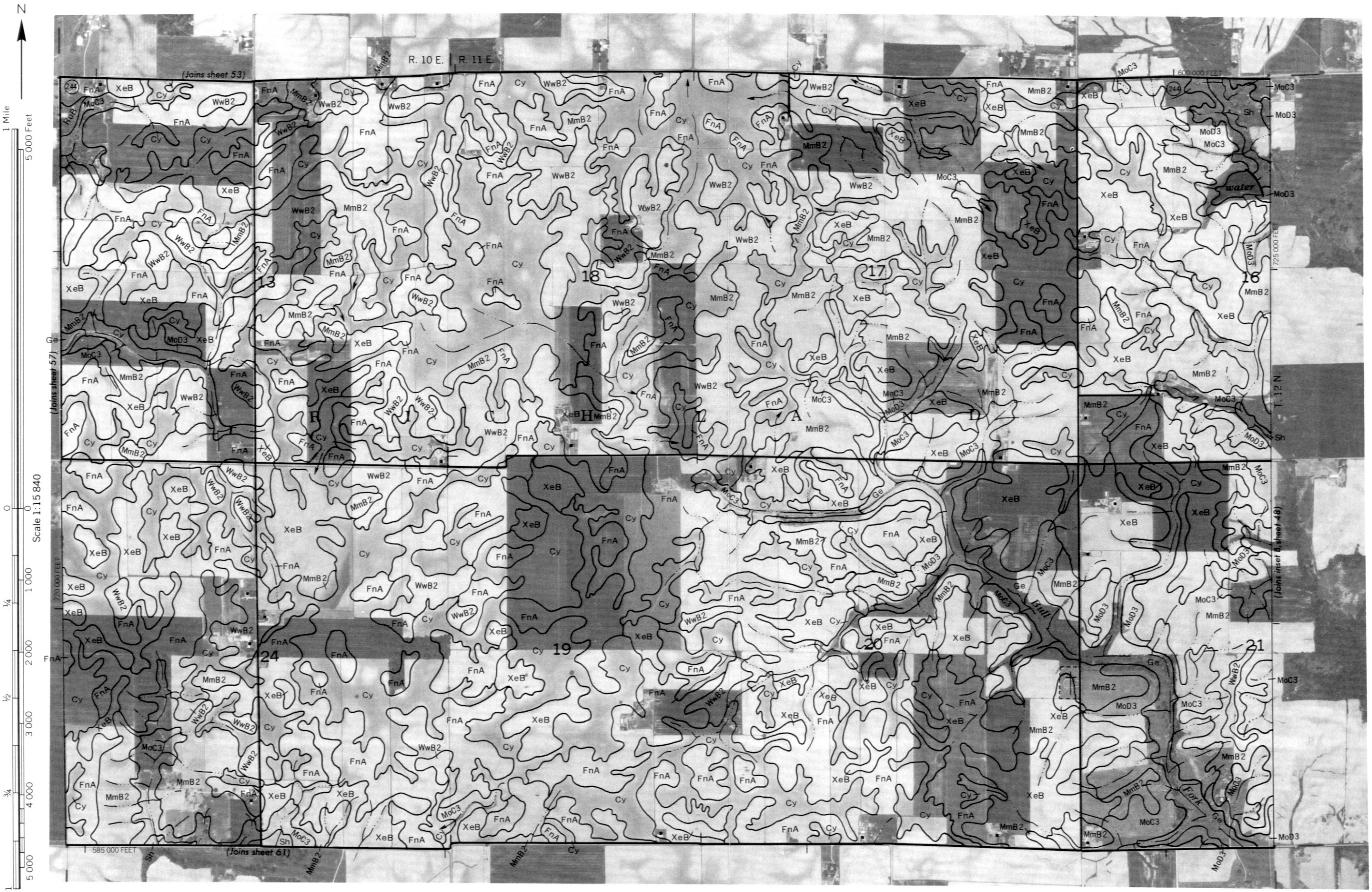

N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 49)
(Joins sheet 59)
(Joins sheet 55)
R. 8 E.
R. 9 E.
T. 12 N.
SHELBY COUNTY
525 000 FEET
515 000 FEET
720 000 FEET
RANGE
Little Conn's Creek
Deer Creek
Mill Creek
APPLE DITCH
15
14
13
18
22
23
24
19



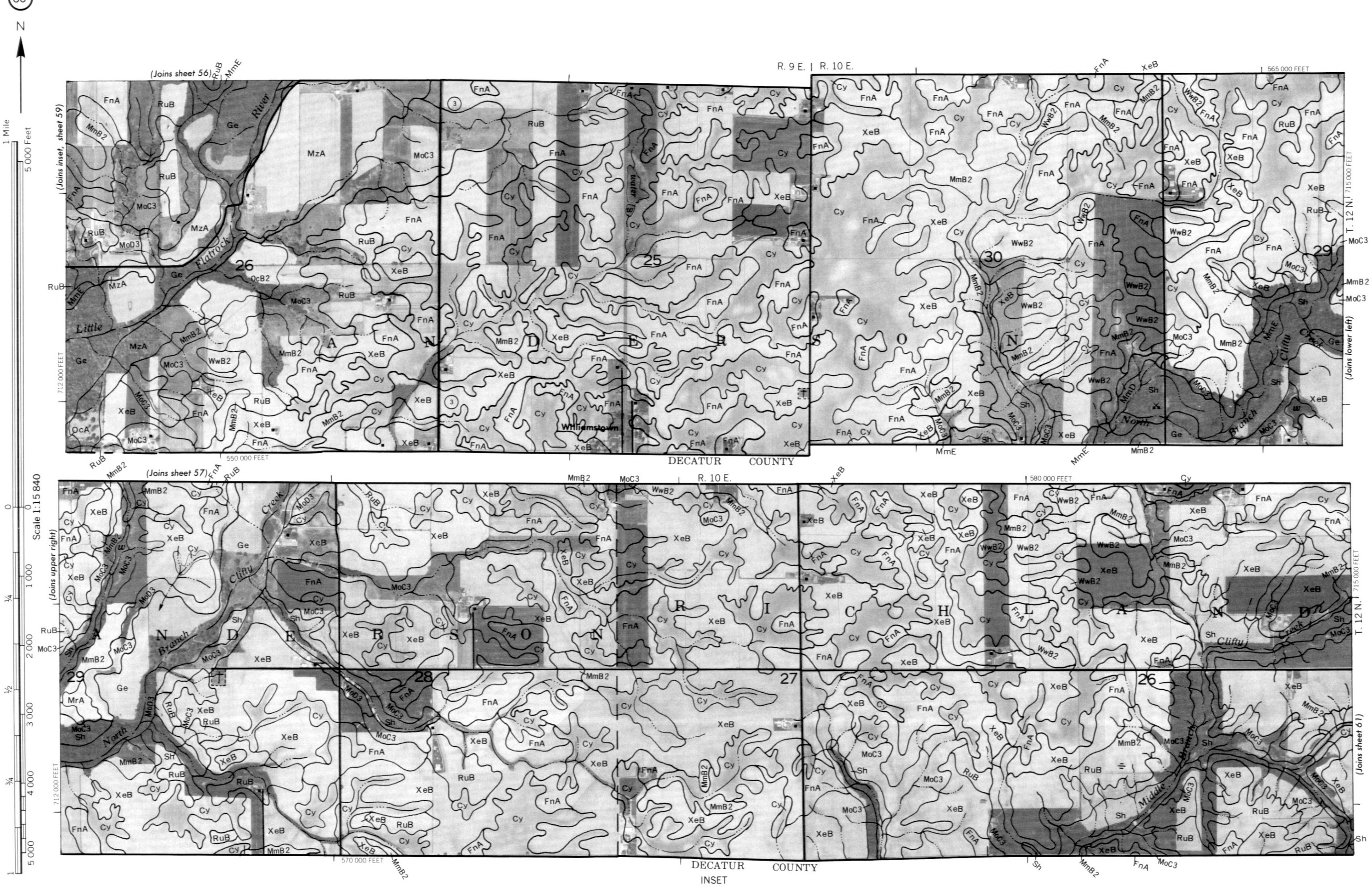
N
530 000 FEET
R. 9 E.
(Joins sheet 50)
725 000 FEET
T. 12 N.
(Joins sheet 54)
(Joins sheet 56)
(Joins inset, sheet 59)
545 000 FEET
720 000 FEET
Moscow
Flatrock River
Little Hurricane Creek
Hurricane Creek
water
18
17
16
15
19
20
21
22
O R A N G E
O R A N G E
1 Mile
5 000 Feet
Scale 1:15 840


56
N
(Joins sheet 51)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 60)
Milroy
Lick
Creek
River
Flatrock
Little
R. 9 E.
R. 10 E.
T. 12 N.
565 000 FEET
725 000 FEET
720 000 FEET
550 000 FEET
A N D E R S O N
14
13
18
17
23
24
19
20
1 Mile
5 000 Feet
Scale 1:15 840

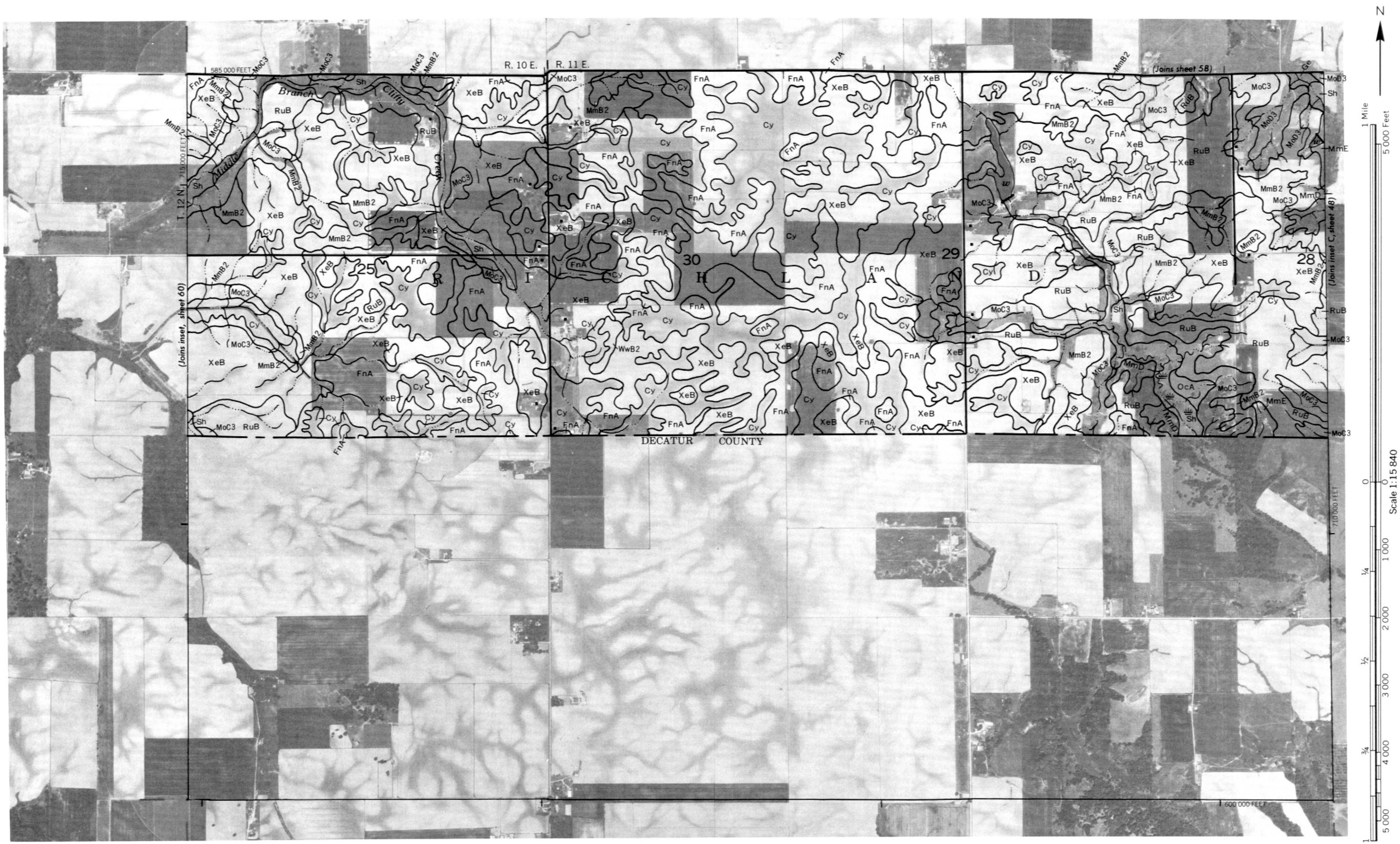

N
(Joins sheet 52)
(Joins sheet 58)
(Joins sheet 56)
(Joins inset, sheet 60)
R. 10 E.
T. 12 N.
Richland
Clifty
Creek
North
Branch
A N D E R S O N
R I C H L A N D
570 000 FEET
580 000 FEET
725 000 FEET
720 000 FEET
17
16
15
14
20
21
22
23
1 Mile
5 000 Feet
Scale 1:15 840


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 53)
(Joins sheet 57)
(Joins sheet 61)
(Joins inset B, sheet 48)
R. 10 E.
R. 11 E.
T. 12 N.
R I C H L A N D
13
16
17
18
19
20
21
24
600 000 FEET
585 000 FEET
720 000 FEET
725 000 FEET
water
Bull
Fork
XeB
Cy
FnA
WwB2
MmB2
MoC3
MoD3
Ge
Sh
RuB

RUSH COUNTY, INDIANA — SHEET NUMBER 59



3000 AND 5000-FOOT GRID TICKS


N
R. 10 E.
R. 11 E.
T. 12 N.
585 000 FEET
715 000 FEET
710 000 FEET
600 000 FEET
(Joins sheet 58)
(Joins inset, sheet 60)
(Joins inset C, sheet 48)
Middle Branch
Clifty Creek
25
30
29
28
R I C H L A N D
DECATUR COUNTY
1 Mile
5 000 Feet
Scale 1:15 840
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000